

ILLINOIS RIVER BASIN ACTION PLAN

SPECIAL REPORT NO. 11

OF THE

ILLINOIS STATE WATER PLAN TASK FORCE

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Executive Summary Introduction	1
Governor's Conference on Illinois River Management	4
State Agency Response	9
Sedimentation	10
Erosion Control	14
Flooding	16
Water Quality	18
Aquatic Habitat, Forestry, Wildlife and Natural Areas	20
Illinois' Lake Michigan Water Diversion	23
Recreation	24
Commercial Navigation	26
Drinking Water Supply	27
Wastewater Disposal	28
Hydropower	29
Agriculture	30
Urban Stormwater Management	31
Commercial Fish and Mussel Resources	33
Archaeological, Historical and Paleobiological Resources	35
Economic Development	37

MAIN REPORT

Action Plan Introduction	41
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MAIN REPORT, Cont.

Governor's Conference on Illinois River Management	41
Sedimentation	52
Erosion Control	67
Flooding	82
Water quality	90
Aquatic Habitat, Forestry, Wildlife, and Natural Areas	101
Lake Michigan Diversion	114
Recreation	122
Commercial Navigation	129
Drinking Water Supply	138
Wastewater Disposal	142
Hydropower	145
Agriculture	153
Urban Stormwater Management	161
Commercial Fish and Mussel Resources	168
Archaeological, Historical, and Paleobiological Resources	174
Economic Development	180

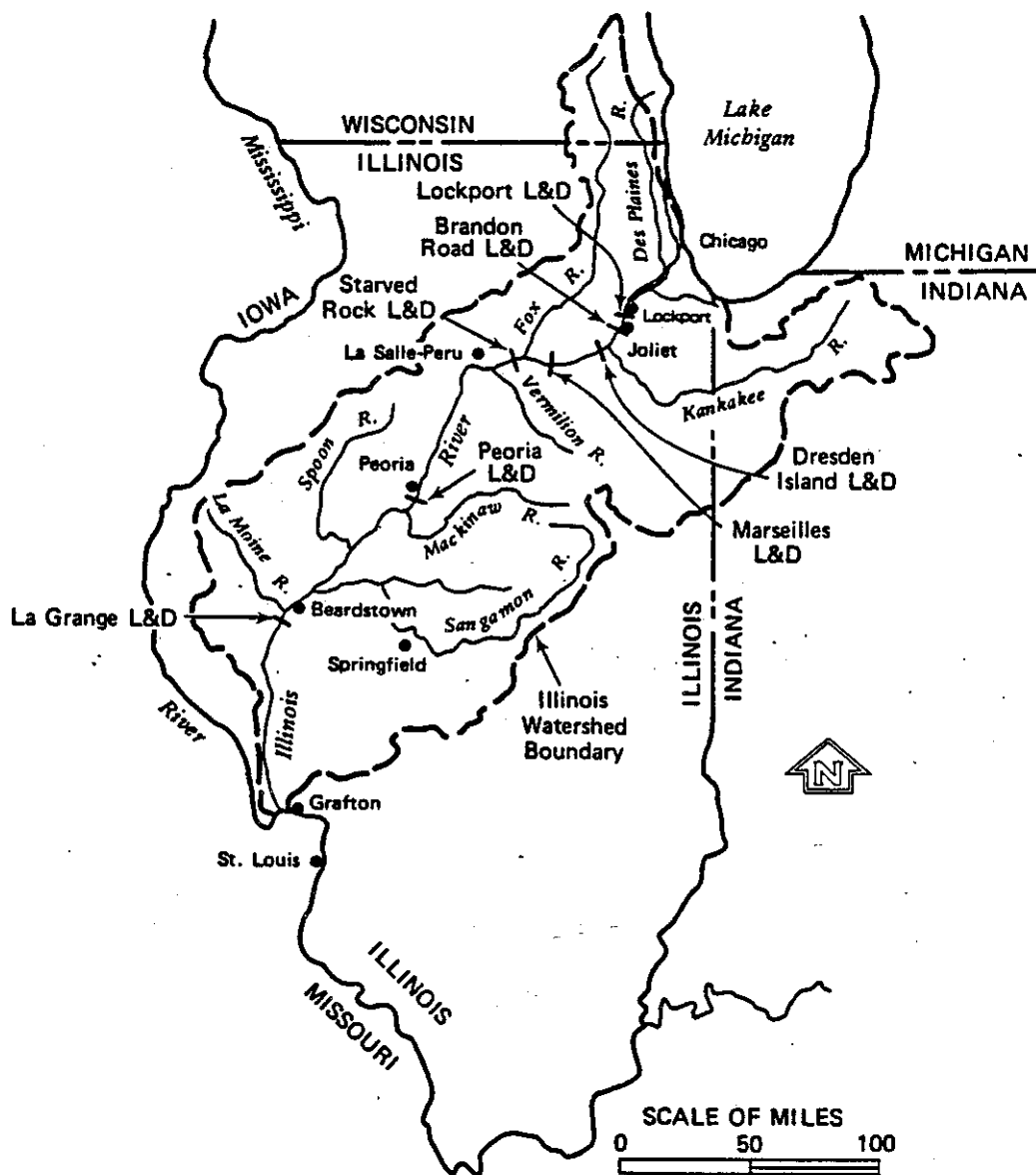
Executive Summary Introduction

This Executive Summary is intended to fill a conventional role in the Report. It is also intended to stand alone as a separate and complete, but brief, report on An Action Plan for Illinois River Management. This Executive Summary contains a map of the Illinois River Watershed and a Table of Illinois River Basin Issues and Agencies.

This is a report from Illinois State agencies operating through the Water Plan Task Force. It deals with management of the Illinois River and its watershed, and it responds to grass-roots concerns for the basin, as expressed by an April 1-3, 1987 conference and its published proceedings.

This report summarizes the expressed problems and priorities of the April conference as reported in the Proceedings "Management of the Illinois River System: The 1990's and Beyond", as well as sponsorship and planning events leading to the conference. The conference was also designated "A Governor's Conference", and Governor Thompson attended on the first day and cruised Peoria Lake. It was also announced that the Governor had requested the State Water Plan Task Force to review the Conference Proceedings and prepare a recommended action plan.

The body of this report consists of 16 issue papers covering the important topics of concern. These constitute the requested action program of solutions in response to the concerns raised at the April conference.



ILLINOIS WATERWAY

ILLINOIS RIVER BASIN ISSUES AND AGENCIES

<u>ISSUE</u>	<u>LEAD AGENCY/SUPPORT AGENCIES</u>
1. Sedimentation	Energy and Natural Resources (DENR) Dept. of Conservation (DOC) Environmental Protection Agency (EPA)
2. Erosion Control	Dept. of Agriculture DOC DENR EPA
3. Flooding	Dept. of Transportation (DOT) DENR
4. Water Quality	EPA DENR
5. Aquatic Habitat Forestry, Wildlife and Natural Resources	DOC DENR
6. Lake Michigan Diversion	DOT DENR
7. Recreation	DOC
8. Commercial Navigation	DOT DENR
9. Drinking Water Supply	EPA
10. Wastewater Disposal	EPA
11. Hydropower	DENR DOT
12. Agriculture	DOA EPA
13. Urban Stormwater Management	EPA DENR
14. Commerical Fish and Mussel Resources	DOC DENR
15. Archaeological, Historical, and Paleobiological Resources	DENR Ill. Historic Preservation Agency
16. Economic Development	Dept. of Commerce and Community Affairs

Governor's Conference on Illinois River Management

Approximately 250 people attended the conference in Peoria on April 1-3, 1987. The conference was divided into three subject areas dealing with a) physical and engineering aspects, b) natural resources and biological, and c) economic aspects. Within each of the subject areas state-of-the-art papers were followed by discussions in 11 workshop groups. Each of the workshops under a chairman and reporter sought a consensus on the problems and their relative priorities. Possible solutions were also identified.

Welcomes and Keynote Addresses

Conferees were welcomed by the Chairman, the Mayor of Peoria, and the Chairwoman of the Peoria County Board. Keynote speakers outlined the consequences of inadequate water management, cited benefits of improved management, and emphasized the trend to greater state and local authority and responsibilities in government.

A Historical Background on the Illinois River

Historically, the Illinois River was one of the most productive rivers in North America, its fish and wildlife populations virtually unequaled. Today, even after experiencing drastic changes brought about by human intervention, the Illinois River remains our state's most important river system. Its basin and tributaries total 32,081 square miles and include over half of the area of Illinois as well as parts of Wisconsin and Indiana. Accordingly, the Illinois River is affected by and affects the majority of our state's citizens.

Five major changes have been imposed by our society on the Illinois River system since the turn of the century. An appreciable volume of water diverted from Lake Michigan entered the Illinois River in 1900 when the Sanitary and Ship Canal was opened at Chicago. Shortly thereafter, vast quantities of untreated domestic sewage and industrial wastes from Chicago were flushed through the Canal into the Illinois River and away from Lake Michigan, a source of the city's water. Thirty-eight organized drainage and levee districts and three private levees were developed for agricultural purposes between 1902 and 1929, and they greatly modified the hydrology and landscape of the valley. Six dams-five along the Illinois and another below its mouth at Alton on the Mississippi-were constructed during the 1930's to create a channel 9 feet in depth for commercial navigation. In recent decades, sedimentation has dramatically affected the river and its adjacent waters.

Sedimentation, today's major pollutant of our nation's agricultural waterways, is the primary obstacle in preserving some semblance of the historic Illinois River for future generations. Restoration of portions of the river valley by reclaiming selected drainage and levee districts is one plausible approach; however, any alternative must be accompanied by a land-use policy that is both economically sound and ecologically intelligent.

Physical and Engineering Aspects

Commercial Navigation - The State of Illinois offers a distinct geographic and economic advantage to shippers due to its midwest location at the confluence of the Great lakes and the inland waterway system. Therefore, the subject is of great importance, yet it does not constitute a major problem calling for immediate action programs to correct serious problems. It is also true that although state and local governments have roles to play, considerable responsibility for the management of commercial navigation resides with the federal government.

Lake Michigan Diversion - High water levels on the Great Lakes with widespread flooding and shoreline erosion and damage have again renewed interest in increasing the diversion from Lake Michigan to the Illinois River among other possible responses. The International Joint Commission is currently studying these options.

It is the opinion of the Division of Water Resources that any federal legislation calling for an increased diversion at Chicago should contain the following key elements:

1. Any authorization for an increased diversion at Chicago should be part of a recommended plan of action between Canada and the U.S.
2. The recommended plan of action should include all existing control measures which can be used to reduce water levels on the Great Lakes. This includes not only an increased diversion at Chicago but also stopping or curtailing the diversion of water into Lake Superior at Long Lake and Ogoki, maximizing flows out of the Niagara River and the Welland Canal, including increasing the flows to the Black Rock Lock during the non-navigation season.
3. The recommended plan of action should be implemented only during periods of high lake levels.

River Forecasting - It is clear that efficient management of all aspects of the Illinois River system requires advance knowledge of flow conditions.

River forecasting for the Illinois River is not easy because of the large basin size and variability. The slopes vary from flat to rolling, and the land use from urban to cultivated and forested. For these and other reasons the forecasts have at times been less precise than desirable or possible. Improving the forecasts through enlarged data networks or greater agency attention may be a problem to consider.

The Flooding Problems - Discussion at the April Conference confirmed that flooding remains a serious problem in the Illinois River Basin. Since 1978, the Illinois River has flooded at least once a year, and was severe enough to be declared a disaster area in two or more counties in 1979, 1982, 1983, 1985 and 1986.

It seems clear that a full menu of alternative measures are available and administrative procedures are clear. What seems necessary is a resolve on all levels to devote adequate resources to adopt and implement programs to reduce the large, annual flood losses.

Chicago Region Impact - The greater Chicago area represents one of the largest urban centers in the United States, with a population of over five million people in an area of about 900 square miles. Obviously, such a population concentration and the attendant industrial and commercial enterprises require a complex and extensive water quality management program. It may be equally clear that even with extensive controls and treatment, the Chicago area location at the head of the basin, will have numerous impacts on the Illinois River downstream.

The principal water management agency in the Chicago area is the Metropolitan Sanitary District of Greater Chicago (MSDGC). Today sewage receives at least secondary treatment. The District maintains programs of stream aeration, land disposal of removed solids, and control of industrial waste.

A major problem of the Chicago area has resulted from the combined sewers. During storm periods runoff mixed with untreated sewage frequently exceeded the system capacity, resulting in both basement and local street flooding. Excessive storm flows require the release of polluted waters to Lake Michigan, threatening the water supply and bathing beaches. A solution to this problem is being implemented in the Tunnel and Reservoir Plan (TARP).

Natural Resources and Biological Aspects

The Illinois Department of Conservation is a major agency in the natural resources and biological areas. Its mission is to protect and manage the State's natural resources and provide outdoor recreation opportunities.

Fish and Wildlife - Aside from aesthetic values of fish and wildlife, there are important economic considerations. The Illinois River and its backwaters provide about 2.1 million angling days. Based on an average of \$12 spent by fishermen per day this amounts to \$25.2 million annually.

Hunting and trapping also contribute to the Illinois River economy. Peak fall migrations often exceed one million ducks on the River. It is estimated that waterfowl hunters expended a total of \$4.6 million in 1985. Deer hunters in counties along the Illinois River spent an estimated \$2.6 million. Small game hunters spent \$6.8 million. The value of furs is estimated at \$800,000 for the 1984-85 season.

Water Quality - Many will be surprised to learn that on an organic waste load basis, the Illinois is in the best condition of more than 100 years. Carbonaceous waste loads have been reduced 91 percent since 1922, and in the Peoria area there has been a 97 percent reduction in organic waste discharges since 1925. This has been achieved by municipal and industrial treatment, particularly during the past 15 years. Reductions in the Chicago region through treatment and the TARP program are particularly notable.

Reductions in the organic loadings result in improved levels of dissolved oxygen (DO) which raises the aesthetic quality and the environment for desirable aquatic life.

Soil Erosion - A number of Illinois River management problems point to erosion and siltation as a serious problem. The nature and source of the erosion problem is documented in the Proceedings of the Peoria Conference and in various other sources. It is established that the bulk of erosion products is from crop land in the form of sheet, rill, and gully erosion. A variety of means for reduction of erosion are available through conservation methods. Streambank erosion has more recently come to be recognized as an important source of erosion products at least in some areas.

Active erosion control programs date back to about 1934, but progress has been slow. Currently, programs for the Illinois basin are striving to reach "T by 2000". These are levels of soil loss that can be permitted but still maintain long-term productivity of the soil resource. Such levels would also eliminate many of the off-site problems which have been cited. Unfortunately, mid-course checks indicate that the programs to achieve T by 2000 are behind schedule.

Innovative Ideas for Water Management. In contrast to conventional approaches to waste treatment and discharge of drainage and flood waters, closed systems are proposed by some. Used water can be sent through the natural cleansing systems of soil, plants, air and sunshine for reclamation and reuse.

Demographic and Economic Aspects

The region accounted for 56 percent of the State's total personal income, with the largest share in Cook County. Per capita personal income ranges from a high of \$14,328 in Grundy County to a low of \$9,409 in Schuyler County. These compare with a state average of \$13,705.

Agriculture and Industry - The region is an important agricultural area with livestock receipts of \$419,875,000 or 18 percent of the states' total. Crop receipts were \$1,001,739,000 or 17 percent of the states' total.

The region is an important industrial area with about 58 percent of the construction and manufacturing employment of the state.

Peoria: A Model Development - Life in early Peoria was oriented to the river as settlers arrived and grain and other products were shipped. Great breweries and distilleries, as well as other industries prospered by the water. Eventually industrial growth virtually closed public access to the river.

In more recent times circumstances permitted the City of Peoria to acquire 37 acres of riverfront property with support from a state grant. Combined with other property the city now controls about 1 1/2 miles of land along the river.

It is of critical importance to the riverfront development that Lake Peoria remain an attractive and open body of water. If siltation were to convert the area to mud flats the reason for the development would be lost.

Priorities and Recommendations

The Peoria conference was structured so that each technical session presenting papers was followed by workshops divided into eleven groups.

Out of this process there emerged a consensus of top priority problems as:

1. Soil erosion and siltation
2. Flooding
3. Lack of public awareness
4. Diversion of Lake Michigan

Some 33 additional problems were sufficiently discussed to be reported in the proceedings. There was a consensus that all the top problems require immediate action.

The Conference leadership suggested the following recommendations based upon the Conference.

1. The formation of a post-conference advocacy committee to set goals, objectives, determine a time frame for action and attempt to estimate costs.
2. Interact closely with state and federal agencies that deal with the management of the Illinois River systems and its environmental condition.
3. Organize an annual event to exchange information on solving problems, but choosing the site of the meeting at other prominent cities or places along the river, e.g.
4. Continue to focus media attention on the Illinois River system.

State Agency Response

The response of State agencies to the problems and concerns raised at the Peoria Conference is organized into 16 issue papers in the full report. A common format was adopted for these and the subjects are listed in the preceeding table.

For the Executive Summary an abbreviated form was adopted for each of the issue papers, and these are in the following sections.

SEDIMENTATION

Erosion and sedimentation are natural processes that cannot be stopped or eliminated. Human interventions such as alteration of stream courses, construction of locks and dams, changes in flow regime (including increased flow due to diversion), constriction and alterations of floodplains, and drastic changes in land use patterns have accelerated both of these processes, significantly impacting the Illinois River including its backwater and bottomland lakes. Many of the backwater lakes are losing their depths at the rate of 0.81 to 2.10 inches per year. Some of them are now nothing but broad mudflats and can no longer be considered backwater lakes. In general, the capacity losses of backwater lakes are higher than those of other manmade lakes.

Loss of capacity for most backwater lakes starts from their connecting channel with the Illinois River and then progresses gradually inward. Morphometric variations at the river-tributary confluences are responsible for extremely high sedimentation rates of many bottomland lakes such as Peoria Lake, which has lost 68 percent of its 1903 capacity. The rate of capacity loss of this lake has been shown to be higher during the last 20 years than in previous periods. Sedimentation of the waterways impacts aquatic habitats, impedes the operation of commercial and recreational traffic, constricts the conveyance channel, and transforms these water bodies into shallow water and wetlands. Erosion and sedimentation have been recognized as the "number one" water resources problem facing the State of Illinois. Various alternatives are available and can be implemented to alleviate the chronic sedimentation problems of this major river. A concerted effort by Illinois natural resources agencies in cooperation with local interest groups is essential in evaluating, initiating, and implementing alternative solutions for revitalizing selected backwater and bottomland lakes along the Illinois River.

Before a course of action is recommended, it must be pointed out that the Illinois River cannot be returned to its original pristine condition. Moreover, some areas of the bottomlands and backwater lakes have undergone almost irreversible changes and can not be altered or revitalized without significant cost and effort. It is essential that a thorough evaluation of the backwater and bottomland lakes be made to determine the area or areas of these resources that are of significant value to Illinois citizens. Once this determination has been made, efforts should be concentrated to revitalize only these high-value areas.

The recently completed Governor's Conference on the Illinois River has identified siltation as the number one problem facing the Illinois River. The following recommendations were developed after consideration of this and other research reports evaluated for this issue paper.

The recommended "courses of action" are divided into two broad categories: resource information and plan of action.

I. Resource Information: Basic information is essential in the development of any management alternative if we hope to have any long-lasting impact. The following resource information is needed:

- o A sedimentation survey of these selected backwater lakes will provide information about the present state of these lakes. Sedimentation surveys of the backwater lakes will require \$175,000 per year for three years and these funds should be made available to the Illinois State Water Survey (ISWS), Department of Energy and Natural Resources (DENR). A centralized data bank where physical, chemical, and biological data and information are stored and updated periodically will not only assist us in developing proper management alternatives, but will also enhance our ability to respond to critical issues that will face us during extreme events such as drought and floods. Cost of this program will be \$75,000 per year and the program should be housed at the ISWS (DENR).
- o Extremely limited amounts of data and information are presently available on sediment loads carried by streams and rivers that drain directly into the Illinois River. State natural resources agencies should initiate and support a program of instream sediment load measurements including the quality of sediment at selected gaging stations on the tributaries and main stem of the Illinois River. This program would be housed at the State Water Survey (DENR) and would compliment the Benchmark Sediment Network presently operated by the Water Survey. This course of action is similar to actions recommended by the State Water Plan Task Force in their Special Report 10 of August 1985. Annual cost for such a program for the State would be \$325,000 with an additional first year's cost of \$110,000 for the initiation of the program.

II. Plan of Action: The "plan of action" is subdivided into three subheadings: Peoria Lake sediment management, in-lake management, and sediment input control. In-lake sediment management will have immediate impacts or benefits, and sediment input control will probably start to show an impact on the receiving lakes within the next 5 to 10 years. Intelligent meshing of "in-lake sediment management" with "sediment input control" is essential to obtain long-lasting benefits for all the backwater lakes, including Peoria Lake and the backwater lakes along the Illinois River. This plan of action also includes demonstration projects that can be initiated easily.

Peoria Lake Sediment Management:

- o The state natural resources agencies under the leadership of

the Illinois State Water Survey (DENR) should work with local area interests to develop a comprehensive management program for Peoria Lake consistent with the recommendations made in the "Peoria Lake Sediment Investigation" report published by the State Water Survey. This activity will require \$250,000 and these funds should be made available to ISWS (DENR).

- o The state natural resources agencies should continue to pursue Corps of Engineers' FY 89 environmental management program funding for the island demonstration project in Peoria Lake. Present estimated cost of this program by the U. S. Army Corps of Engineers is \$3.3 million. If this project is funded by the Environmental Management Program of the Upper Mississippi River, 25% of the total cost must be cost shared by the State and local agencies. Lead agencies for this program would be IDOC and DENR.

In-Lake Management:

- o High-value areas beyond Lake Peoria and within the backwater and bottomland lakes should be identified by the state natural resources agencies under the leadership of ISWS (DENR) and local concerned officials and citizens. A comprehensive management plan should be developed for these backwater and bottomland lakes. Total cost would be \$500,000 for a period of three years.
- o Techniques should be developed and implemented for the removal of sediment by selective dredging. Research should be conducted by DENR (ISWS, INHS, ISGS) and the estimated cost for this activity is \$100,000 per year for 3 years.
- o Concepts should be developed and feasibility studies should be conducted by ISWS (DENR) for creating artificial islands (similar to those now being studied by the Water Survey for Peoria Lake), public parks, playgrounds, etc., in the immediate vicinity of the dredging sites with dredged materials. Estimated cost for such an activity would be \$100,000 per year for 2 years.
- o Techniques should be identified and developed for controlling the sediment input to selected backwater lakes from the Illinois River by using methods such as gated control structures. Research for feasibility studies will be needed and should be conducted by ISWS (DENR) and will cost \$75,000 per year for 2 years.
- o Management techniques should be developed and implemented so that some or portions of the backwater lakes can be managed as shallow water wetlands, and terrestrial habitats. Such work should be undertaken by the State natural resources agencies.

Sediment Input Control:

- o Low-cost bank stabilization techniques should be developed and implemented for streams located within the immediate vicinity of the river and backwater lakes. ISWS (DENR) and IDOC should be the lead agencies and annual costs would be \$200,000.
- o Best management practices should be implemented on the highly erodible areas of the watershed. For cost estimate, see "Erosion Control" issue paper.
- o The public must be made aware that a state permit is required for stream channel modification or floodway construction.
- o IDOT-Division of Water Resources permit requirements will include provisions to reduce erosion and preserve stream channel stability.
- o Concerned state agencies should work with local units of government to encourage the incorporation of streamside vegetative buffers for all new and existing developments in both rural and urban areas.
- o Any state or federally funded projects on waterways, streams, rivers, lakes, or wetlands should be reviewed by the state natural resources agencies for determination of their potential impact on the erosion and sedimentation of the concerned bodies of water.

EROSION CONTROL

Soil Erosion is a ubiquitous and costly process. Ubiquitous - in that soil erosion to some degree occurs with each rainfall event. Erosion is a natural phenomenon that can never be stopped, but can be controlled and reduced to tolerable limits. Soil erosion is costly - requiring significant amounts of capital to control the erosion while still allowing for the production of normal agricultural commodities on rural lands as well as protection of the resource base on both the rural and urban lands. In addition to the landowner's cost of controlling erosion on-site, off-site deposition of the eroded soil in streams, rivers, lakes, road ditches, streets, sewers and other areas causes far greater expense to the public through remedial actions as well as decreasing the utility and value of the affected land and water resources.

Soil and Water Conservation Districts in cooperation with individuals both rural and urban, have been working to control agricultural streambank and urban/construction site soil erosion for nearly fifty years. Much progress has been made, but much still remains to be done. To meet the State's goal of T by 2000 on agricultural lands, and to address erosion on other non-agricultural acres, current programs need to be strengthened and new areas for action should be examined. The following courses of action are recommended as a means toward that end.

- o State cost-share funding for erosion control should be increased and extended beyond the initial five-year authorization period. Estimates indicate that \$160,000,000 will be needed in the next 12 years to meet T by 2000 goals for the Illinois Basin.
- o Soil and Water Conservation Districts will require an estimated \$5,000,000 per year from increased local as well as state sources of revenue to enable the employment of full-time experienced staff to work on the erosion control program.
- o The Illinois Conservation Enhancement Act, approved by the 85th General Assembly, should be adopted and funded at the requested \$10,000,000 level. This bill would supplement the federal Conservation Reserve Program, removing highly erodible land from crop production.
- o The proposed Bureau of Agricultural Development should be created and funded at \$100,000 annually, as a means of providing assistance to farmers in choosing alternative land uses that will keep soil erosion loss at or below "T".
- o Legislation needs to be enacted which would provide for assessments at one-sixth of the value for farmers who voluntarily take marginal land out of production.

- o The Illinois Department of Transportation - Division of Water Resources should promulgate and enforce construction permit regulations to assure that proper permit authority/management practices are in place to mitigate impacts from stream alteration. This will require \$105,000 per year.
- o A continuous research program should be funded by the ISWS DENR to: 1) define the erosion and sedimentation relationship, 2) determine effectiveness of Best Management Practices for controlling water quality degradation, 3) define critical areas for solving downstream sediment and water quality problems, and 4) define biological and water quality benefits/damages of any sediment control techniques. Total annual cost for research would be \$250,000 per year for three years and the monitoring would cost \$500,000 per year.
- o During the development of conservation farm plans, soil and water conservation districts and the USDA Soil Conservation Service should provide leadership in encouraging riparian landowners to adopt stream corridor protection measures through the use of critical area seedings, vegetative filter strips, and field windbreak practices.

FLOODING

Most of the major Illinois river flood control projects have been completed. Overall basin planning has concluded that large scale flood control reservoirs are not feasible. Channel dredging is still being considered in the Peoria Lake area, but if it is funded it will be for recreational and habitat purposes and should not affect flood levels.

The current approach is now to look at the special circumstances and options for each community. Many communities on the Illinois River and its tributaries have had reconnaissance studies completed. Where structural projects were shown to be appropriate, the state or federal agency has proceeded towards implementation. Two examples of this are Pontiac and Liverpool, both of which are having their detailed plans finalized.

It has been determined that structural flood control projects will not be feasible in most of the remaining communities. Accordingly, it has been recommended that federal, state and local agencies proceed with nonstructural flood control planning for the rest.

The following action items are recommended to aid in the implementation of this flood control program.

- o Provide additional state technical support and guidance for the preparation of local flood hazard mitigation plans. This will require a state budget increase of \$100,000 per year.
- o Make technical staff available to provide direct advice to owners of flood-prone property on retrofitting, flood insurance, emergency response planning, and other methods to reduce flood damages. This will require that the Division of Water Resources add to its staff a full time flood damage mitigation urban planner.
- o Provide funds to complement available federal funding programs to support implementation of community flood hazard mitigation plans at a level of \$2,000,000 per year. Particular attention should be given to funding acquisition of floodplain property to convert areas of damage-prone buildings to public open space.
- o Encourage at all levels of government stricter floodplain regulatory standards such as prohibiting the construction of new buildings in the floodway.
- o Provide state sponsored training and guidance for the preparation of local flood fighting plans.

- o It is recommended that the Floodplain Information Repository at the Illinois State Water Survey (SWS) be updated on a regular basis, particularly in areas of extensive urbanization. The Repository should continue to provide flood elevations, flood zone determinations, and other flood related information to citizens, institutions, and communities of the State. This SWS program will require \$130,000 per year in new funding.
- o A detailed basin by basin analysis of agricultural levee placement will be conducted in order to improve flood control planning and permitting decisions in rural areas.

WATER QUALITY

The Illinois River Basin has seen significant improvement in water quality over the past 15-20 years. Although problems such as sedimentation, periodic low dissolved oxygen (DO) concentrations, and excursions of other water quality parameters beyond applicable standard still exist, all historical data point to marked improved in water chemistry.

These improvements can be credited to State and local efforts in waste management. These efforts have significantly reduced waste contamination through an intensive permit and monitoring program throughout the Basin. Recent studies by the State Water Survey on sludge deposits in the Illinois River Basin also show marked improvement in the reduction of heavy metals. These improvements reflect the upgraded treatment efforts of domestic and industrial dischargers.

The most significant remaining water quality problem in the Illinois River Basin is sediment/turbidity primarily of nonpoint source origin. Agricultural practices are considered as the primary source of these pollutants. To combat this problem, a variety of efforts with technical and financial support from State agencies, has been implemented. The initial findings of these efforts is that sediment/turbidity pollution will continue unless further measures, especially at local levels, are implemented.

Additionally, the increased assessment for toxic contaminants show that efforts to monitor toxics should be expanded while maintaining our "historical" monitoring base for trend analysis purposes.

The following are recommendations for continued water quality assessment:

- o Continue the extensive water quality monitoring and evaluation programs now occurring while expanding assessments into the new generation chemicals (i.e. pesticides, organic chemicals) with manpower and laboratory capabilities to effectively analyze the samples. Increased fish contaminant monitoring would further enhance the State's ability to evaluate and advise the public on suitability of sport fish taken within the Basin for human consumption. This will cost \$350,000 per year for SWS participation.
- o Local government should take a more active and aggressive role in non-point source control through enactment of limited-use zoning, construction ordinances, development of stormwater management programs and creation of local revenue generation strategies for capital projects directed at erosion control.

- o The State through DENR and IEPA should establish a statewide sediment monitoring network to evaluate the magnitude of the problem and designate key problem areas in order to assist State and local officials in implementing control measures. Program costs are identified in the sedimentation issue paper.
- o The IEPA will make an aggressive effort to implement the USEPA program recommendations for management of stormwater discharge consistent with Section 405 of the Water Quality Act.
- o Best management practices (BMP's) for control of nonpoint source pollution should be implemented at all levels due to the benefits of sedimentation reduction, and their associated contaminants (i.e. pesticides, heavy metals, organic chemicals, etc.).

AQUATIC HABITAT, FORESTRY, WILDLIFE, AND NATURAL AREAS

The Illinois River basin was once an area with a wealth of natural resources - fertile soils, forests, clean rivers, and rich habitats of marshes, sloughs, ponds and lakes. This richness supported a myriad of waterfowl, furbearers, and fish. Many changes have occurred within the basin in the past 100 years which have had a significant impact upon the river and its fish and wildlife, as summarized in another part of the report.

A major blow to the rich Illinois River Basin was the diversion of sewage from Chicago into the Illinois River in 1900. Upper stretches of the river became void of oxygen and toxic. After 1908, fish production in the Illinois River declined sharply. The sewage slowly spread its lethal pollution downstream. During this time agricultural development was also occurring. As a result, about 200,000 acres of rich bottomlands along the Illinois River were drained. Then during the 1930's navigation dams were built to promote barge transportation on the Illinois River. The heavy barge traffic causes scouring of the river bottom and shorelines disturbing fish spawning and feeding areas. Intensifying the problem, modern agricultural practices have increased soil erosion and sedimentation so that bottomland lakes, which are essential fish and wildlife habitat areas, are being filled with sediments. The sedimentation and agricultural development have minimized the acres of bottomland habitat left in the basin.

Although improvement of water quality in recent years has restored some fish to the Illinois River such as catfish, white bass, large mouth bass, smallmouth bass, and walleye, the damage to fish and wildlife habits is continuing to occur even today. This is evidenced by the decline of waterfowl on the Illinois River. The continuing sedimentation of lakes and bottom lands and the toxicity of bottom sediments still further degrades the remaining fish and wildlife habitats.

Immediate and significant steps need to be taken to increase the fish and wildlife populations, improve their habitats, and slow the sedimentation of lakes and bottomlands in the Illinois River basin. Such recommended steps are:

Aquatic Habitat

- o Continue Department of Conservation (DCC) fisheries monitoring to document impacts of changes in aquatic habitat;
- o. Department of Conservation and State Water Survey (DENS) should evaluate the success of the tire breakwater experiment at Peoria Lake for possible implementation in other areas to encourage re-establishment of aquatic vegetation;

- o Support studies of ways to reduce stream bank erosion, such as the Court Creek studies at an estimated cost of \$100,000 per site;
- o Initiate studies to determine the sources of toxics in bottom sediments, and seek methods to detoxify the sediments;
- o DENR and DOC should continue to assess the importance of deep water areas to survival of fish populations;
- o Initiate DENR and DOC studies to develop effective ways to create backwater areas and to acquire and restore to original conditions leveed floodplains in selected drainage and levee districts; study cost by SWS at \$150,000 per year for 3 years.

Forestry

- o Expand DOC technical assistance programs to advise landowners of ways to protect and better manage their forest lands and to encourage tree plantings and establishment of greenways along streams at a cost of \$300,000 per year;
- o Provide for a strengthened urban forestry program in DOC to encourage municipalities to retain forest lands and to establish greenways at a cost of \$300,000 per year;
- o Recognize the significance of forests in producing higher water quality and provide incentive to owners of forest lands by minimizing taxes on forest lands and maintaining provisions of the Farmland Assessment Act for lower taxes on forest lands;
- o Increase DOC nursery seedlings production by a 4 to 5 fold increase at an initial cost of \$2 million capital and \$1.5 million operating.

Wildlife

- o Provide technical and economic assistance to the Department of Conservation for wildlife habitat development projects such as Banner Marsh levee renovation, Stump Lake levee improvements, and Rice Lake levee and site improvements.
- o Through DOC provide cost-share, grant, or loan funds to private organizations such as duck clubs for developing seasonal off-river lakes to benefit aquatic birds and waterfowl at a total cost of \$10 million;
- o Restore funding to DOC for the Wildlife Habitat Acquisition and Natural Areas Acquisition programs at originally planned levels at a total cost of \$32.5 million;

- o Continue Natural History Survey aerial censuses of waterfowl populations during migrations at \$50,000 per year;

Natural Areas

- o Continue DOC aerial surveys and monitoring of populations of the plant purple loosestrife, which is a severe threat to wetland areas at a total cost of \$10,000.

General

- o Increase staff levels as needed to promote, plan, and coordinate the above recommended actions at State, and local levels, using federal and State cost-share programs as much as possible;
- o Strengthen local zoning requirements to reduce agricultural and urban development in floodplains and to prevent the filling of wetlands;
- o Continue the partnership approach of government and private interest groups, such as with the Partners in Conservation effort, to promote cooperation toward mutually beneficial fish and wildlife improvements;
- o Aggressively work to arrest erosion and sedimentation, concentrating demonstration projects and research at existing sites thus protecting past investments (for specific recommendations see the Sedimentation and Erosion Control issue papers);
- o Complete natural resource inventories by DENR and DOC of streams, wetlands, fish and wildlife, and initiate planning based on the resulting data to identify quality natural resources and to establish priorities for acquisition programs; and
- o Initiate a Statewide Greenways Program to focus resource protection on Illinois' major rivers, such as the Illinois River and its larger tributaries.

ILLINOIS' LAKE MICHIGAN WATER DIVERSION

Illinois' diversion of Lake Michigan water has been controversial ever since its inception. More recently, discussions about an increase in Illinois' diversion has similarly stirred strong feelings on both sides of the issue. The complexity of the Illinois River ecosystem, the influence of both man-made and natural factors on its flow, productivity and quality make quantitative assessment of the impacts of a particular plan for an increased lake Michigan diversion very difficult. A 1981 Corps report found that an increased diversion was not economically justified, considering the impacts on both the Illinois waterway and the Great Lakes system. Concerning environmental impacts on the Illinois waterway, generally the Corps was able to describe both beneficial and adverse effects expected to occur from an increased diversion.

Authorization for an increased diversion at Chicago for the Illinois Waterway requires either an act of Congress or a modification to Illinois' United States Supreme Court Decree. The recent initiative for an increased diversion has been to provide water level relief on the Great Lakes, it is an international issue, and hence, inappropriate to bring before the Supreme Court. It has been Illinois' position that any efforts to resolve the high lake level problem should involve all Great Lakes interests, both Canadian and American, and include all existing controlling measures which can impact on Great Lakes water levels. In addition, in response to the potential adverse impacts which have been described in previous studies of an increased diversion at Chicago, Illinois is opposed to an increased diversion until it can be clearly demonstrated that an operating plan can be developed to adequately protect interests on the Illinois waterway. In keeping with this position, Illinois' efforts have focused on providing input and assistance to the continuing studies of the International Joint Commission and the Corps of Engineers to ensure that any operating plan for an increased diversion at Chicago provides maximum protection to our waterway interests.

- o Therefore, it is recommended that Illinois continue to oppose increased Lake Michigan diversion at Chicago, Illinois until an acceptable operating plan is developed. State agencies must actively cooperate in any future study of increased diversion by the Corps of Engineers or International Joint Commission in order to ensure that an acceptable plan is developed.

RECREATION

Many recreation sites in the Illinois River basin are focused on the rivers and lakes of the basin for recreation. There are water-dependent recreation activities such as fishing, waterfowl hunting, boating, and swimming. There are also water-enhanced recreation activities--activities through proximity to the water. Such activities are hiking, picnicing, and camping. Opportunities for these recreation activities are provided by local, State, and federal agencies, and many private concerns. Often these providers produce recreation development plans independent of each other, resulting in an under supply of certain recreation activities. According to Illinois' 1983 Statewide Comprehensive Outdoor Recreation Policy Plan, the area within the Illinois River basin is in need of a greater supply of camping, fishing, boating, swimming, and hunting opportunities, and trails.

A 1985 survey of Illinois residents showed that swimming and fishing were two of the most popular recreation activities in the state. In general, recreation use is increasing in Illinois.

The recreation sites of the Illinois River basin are directly affected by the quality of the surrounding natural resource. In the basin, degradation of the natural resource is occurring at an alarming rate through channelization, soil erosion, sedimentation, clearing of natural vegetation, and poor water quality. This degradation directly affects the quality and quantity of recreation available in the Illinois River basin. The quality of water-dependent recreation activities at some recreation sites has been threatened by the degradation of the rivers and lakes in the basin. Many potential recreation sites have been converted to agricultural or urban development, or have also experienced degradation of the natural resource.

With a degrading natural resource quality, a diminishing supply of quality potential recreation sites, and a trend of increasing recreation use by the general public, the State should implement the following recommendations:

- o Coordinate and prioritize local and State recreational development activities in order to complement existing programs, such as the Corridors of Opportunity and other Build Illinois efforts;
- o Continue the partnership approach of government and private interest groups, such as with the Partners in Conservation effort, to work toward mutually beneficial recreation developments;
- o Provide a stronger State presence through DOC and DCCA, in river corridor development, including the development of the Illinois River Trail and the Illinois River Road at a total cost of \$500,000;

- o Aggressively work to arrest the degradation of natural resources caused by erosion and sedimentation;
- o DOC should concentrate on developing multi-use recreation opportunities at existing recreation sites;
- o DOC should concentrate acquisition programs on sites with quality natural resources;
- o Complete the DOC natural resource and recreation facilities inventories and use them to establish priorities for acquisition programs and recreation planning;
- o Increase visitor services and programs at existing DOC recreation sites at a cost of \$7 million capital and \$2 million operating;
- o Fund the DOC Wildlife Habitat Acquisition Program and the Natural Areas Acquisition Program at their originally planned levels;
- o Initiate a Statewide Greenways Program through DOC and DCCA to focus resource protection, recreation development, and tourism promotion in such areas as the Illinois River corridor.

COMMERCIAL NAVIGATION

The State of Illinois offers a distinct geographic and economic advantage to shippers due to its Midwest location at the confluence of the Great Lakes and the inland waterway system. The inland waterway system that serves the state includes 1,116 miles on the Mississippi, Illinois, Ohio and Kaskaskia Rivers and 344 waterway terminals that annually handle over 80 million tons of barge shipments.

The capacity of the inland waterway system in the State of Illinois is affected by the condition of the locks and dams. The U.S. Army Corps of Engineers is or will be conducting studies to determine the need for lock improvements and to assess the impacts of commercial navigation on the environment and on recreational uses of the Mississippi River and the Illinois Waterway.

It is critical that the State have ample opportunities to monitor the navigation studies by the Corps of Engineers and to review draft reports on study findings and recommendations. To achieve this oversight responsibility, it is recommended that:

- o IDOT be the lead agency in notifying the Corps of the need for state involvement in ongoing and proposed studies of the impacts of commercial navigation on the environment and recreation uses of the rivers in Illinois.
- o IDOT coordinate its review activities with the Department of Energy and Natural Resources, Department of Conservation and other state agencies as needed.

Due to the contribution of commercial navigation activities to the economies of the communities along the Illinois Waterway, communities can undertake the following types of programs to ensure that future demand for riverfront lands by the barge industry and terminal developers are compatible with community needs and plans for future riverfront uses.

- o Identify riverfront sites suitable for barge fleetings, terminal development and other uses related to the barge industry including the disposal of dredged materials. Also, identify sensitive areas in which such development should be prohibited.
- o Establish a dialogue with barge terminals and barge operators by such means as ad-hoc committees to discuss the needs and problems of the barge industry and to reconcile problems between the barge industry and other local interests.
- o Develop public awareness programs to increase the public's understanding of the contribution of the barge industry to the economy of the local area and the State of Illinois.

DRINKING WATER SUPPLY

There is use of surface water for public water supply purposes within the Illinois River Basin, and generally, sufficient groundwater is available. This source usually requires little treatment, and has minimal costs associated with construction, operation and maintenance of treatment facilities. However, a number of groundwater supplies within the basin obtain water which exceeds the drinking water standard for radium. It may be cost-effective for these communities to develop regional water supplies which would depend on surface water as a source of supply.

Public water supplies within the basin as elsewhere in the State, which rely on surface water impoundments are faced with siltation problems of varying degrees. Other problems with surface water quality, however, tend to be minimal. Seasonal quality fluctuations are the most common problem encountered.

Non-point source problems are to be addressed and as programs are phased in, the public water supplies will benefit. Participation in the program by public water supplies would include use of the intakes and reservoirs as monitoring stations to gauge the overall effectiveness of the programs being implemented.

WASTEWATER DISPOSAL

The treatment and management of wastewater disposal in the Illinois River Basin can be considered a major success. Every major metropolitan area, and hundreds of rural communities, has improved their wastewater treatment with the assistance of an estimated \$2.3 billion dollars of State and Federal funds to match local and private financial inputs. Additionally, hundreds of millions of dollars have been expended by industry to comply with industrial wastewater requirements. Close regulation of these activities and the operational effectiveness of the facilities, is maintained through the National Pollution Discharge Elimination System permit process, and other Federal and State permitting programs for sludge, industrial pre-treatment and other waste/residue disposal.

With fully developed programs in place to address conventional wastewater problems, the State is now placing increased emphasis on the identification, classification, and management of toxic substances. To assure the effectiveness of these programs and the continued success of more "traditional" programs the following are recommended:

- o Continued vigilance is needed in the administration of State and Federal regulations. Review of the utilization of Administrative Authority in the control of land pollution at the IEPA, and Administrative Order authority at the USEPA, indicates that the procedural streamlining and effectiveness acquired through such authority would enhance administrative efforts to assure adequate wastewater treatment and disposal practices.
- o Continued financial support through "Build Illinois" and/or a revolving loan program is needed to help communities defray the costs of compliance with NPDES limits for publicly owned treatment facilities.
- o Local initiatives in continued improvement of operation and management of facilities including refinancing, and "policing" of significant users is needed to assure optimum performance of wastewater collection and treatment facilities.

HYDROPOWER

Hydropower is one of Illinois' largely untapped albeit small renewable resources. At the present time, small-scale or low-head hydropower plants on the Illinois River are operating at the Lockport Dam (capacity 17.0 megawatts or MW) and at Marseilles Dam (2.3 MW). The total potential for the seven locks and dams on the river is estimated as 83.8 MW. These structures serve various purposes such as navigation, recreation, water supply, and hydropower. They usually have adverse effects on water quality in terms of lowered dissolved oxygen (DO) levels because of reduced flow velocities and increased flow depths, and trapping of sediments carrying nutrients and contaminants.

The Corps of Engineers' studies, conducted in the early 1980s, show that hydropower development is economically justifiable at the Brandon Road, Dresden Island, Marseilles (new plant), and Starved Rock locks and dams. The capacity of these plants is estimated as 47.3 MW. According to the Federal Energy Regulatory Commission (FERC), a preliminary permit has been issued for a new plant at Marseilles, and license applications are pending for plants at Brandon Road, Dresden Island, and Starved Rock. Environmental concerns associated with small-scale hydropower development relate to instream flow needs, dissolved oxygen and reaeration techniques, fish passages, and tailwater fishing.

The following recommendations have been developed for possible courses of action when studying hydropower development on the Illinois River:

- o Conduct full hydrologic analyses: All projects should have analyses that include development of daily flow series at the site for 25 years or more, weekly dissolved oxygen and mean temperature values, and monthly values of desired protected or instream flows. The upstream and downstream water stage series should always be developed to calculate the available head.
- o Evaluate the full environmental impacts: Impacts in terms of reduction in dissolved oxygen, reaeration, aquatic habitat, and fish passageways should be investigated in detail. Suitable remedial measures should be identified and their costs determined. Any changes in sediment transport and sedimentation must be investigated and measures to mitigate any adverse impacts be identified.
- o Conduct a thorough economic analyses: These must always be carried out for various values of hydropower capacity that can be developed at the site. Both tangible costs and intangible costs and benefits must be considered to the highest degree possible, to determine the true economic feasibility of a proposed project.

AGRICULTURE

Illinois' farmers as a whole are production oriented. They, as well as the majority of farmers nationwide, believe that the more they produce, the better off they will be financially. It is paradoxical however, that the products that Illinois' farmers know how to produce best frequently cause economic damage to the farmer in terms of surplus commodities and the erosive degradation of the land resource.

If farmers are to escape this dilemma; they must be provided with sound, viable alternatives which will allow for reasonable profits after payment of necessary taxes and farming expenses.

The following courses of action are deemed necessary to assist farmers with the adoption of alternative farming methods.

- o Soil and Water Conservation Districts need to be fully funded from dedicated sources of revenue to allow for the continued employment of qualified personnel to assist farmers in developing farm plans and making proper erosion control management decisions. The amount of funds needed is addressed by a recommendation in the section on Erosion.
- o The University of Illinois Cooperative Extension Service should be provided additional annual appropriation of \$100,000 to develop training workshops to inform and educate farmers in choosing proper return-maximizing management options.
- o Cooperative State, federal and local efforts to inform farmers of the conservation compliance provisions of the 1985 Food Security Act need to be strengthened.
- o The U of I Agricultural Experiment Station should assume leadership in researching and developing alternative profitable land uses for highly erodible land.
- o Farmers must be informed of the benefits of utilizing soil testing and crop scouting to maximize their profitability by utilizing the minimum effective quantities of fertilizer and pesticides.
- o During the development of conservation farm plans, soil and water conservation districts and the USDA Soil Conservation Service should provide leadership in encouraging riparian landowners to adopt stream corridor protection measures through the use of critical area seeding, vegetative filter strips, and field windbreak practices.

URBAN STORMWATER MANAGEMENT

Control/management of urban stormwater has been primarily a function of local government. In a few instances, stormwater discharges from industrial property with potential water quality impacts are regulated under the National Pollution Discharge Elimination System (NPDES) permit program, but for the most part, reliance has been on effective local management practices for the protection of water quality.

Studies by both State and Federal Agencies have identified the water quality impacts of stormwater as a localized intensive impact of short duration. Lead, copper and iron exceeded general use water quality standards 25 to 30 times a year with a once-a-year maximum of 15 to 20 times the standard. Longer term impacts are normally manifested through deposition of pollutants in the bottom sediments of the receiving waterbody and disrupting the aquatic community through direct sediment toxicity or sediment-water interactions.

The Water Quality Act of 1987 renewed and expanded focus on urban stormwater management through Section 319 (nonpoint management) and Section 405 (stormwater discharge permitting). These programs have the strong potential to regulate stormwater discharges through the NPDES permitting process and mandated management/maintenance practices. These Water Quality Act initiatives are focused towards proper management by local units of government.

Considering the historical data collected and the focus of recent legislation, the following activities are recommended:

- o Maximize the education/information transfer functions. A program of education/information transfer would: 1) acquaint developers and local officials with the need for use of proper stormwater management techniques, 2) establish and promote anti-litter activities, and 3) inform homeowners of the proper use and application of fertilizers and pesticides.
- o Municipalities and counties should adopt and enforce adequate stormwater detention ordinances as appropriate. Model ordinances developed by the Northeastern Illinois Planning Commission (Suggested On-Site Stormwater Detention Basin Ordinance, January 1980) and Southwestern Illinois Metropolitan Planning Commission (Model Stormwater Detention Ordinance for Developing Areas, January 1982) are available for reference and consideration by individual communities.
- o Since it is the primary responsibility of the local, State or federal agency to control urban runoff contributions arising from their individually directed activities and facilities, the following preferred control practices are recommended: administrative procedures for personnel training, improved equipment utilization and scheduling, and controlled application programs for de-icing or other related right-of-way clearance programs.

- o Municipalities, township, county and State highway organizations, the Illinois State Toll Highway Authority, and facility engineering departments at State and federal installations should review the effectiveness of programs for control of the application of de-icing materials, personnel training in proper storage and application methods, equipment usage in order to minimize any negative water quality impacts.
- o Although TARP has been an expensive undertaking, the potential benefit of the plan has surfaced during its performance during two major storms in the last year. If phase one of the plan is completed, the storage capacity of the system for water to be treated (water quality phase) would increase from the current 1 billion gallons to approximately 2.2 billion gallons. The stormwater storage phase, phase 2, is just starting at the O'Hare site. If completed, phase 2 would provide an additional 15 billion gallons of storage. This additional storage capacity would have significantly reduced the 100 million dollars in damages incurred during the August 1987 event. It is therefore recommended that funding be sought to complete phase 1 as soon as possible. The cost of this work is easily justifiable in relation to the damages that it would help to circumvent. Additional funding should also be sought for at least 50% completion of phase 2 in a timely manner.

COMMERCIAL FISH AND MUSSEL RESOURCES

During the mid-1800's, commercial fishing and harvesting of mussels were thriving economically important industries within the Illinois River basin. In 1908 commercial fishermen caught a record 24,763,000 pounds of fish from the Illinois River at a value of \$1,135,000. In that same year, the value of the mussel products (shells and pearls) harvested from the Illinois River was worth \$139,000. Soon after these tremendous harvests, the numbers of fish and mussels harvested from the Illinois River began to drop. Over the next 75 years, the importance of these industries to the basin's economy has declined significantly.

This decline was largely due to the diversion of Chicago's sewage to the Illinois River. The sewage caused extreme water pollution using up all the oxygen in the river and producing toxic conditions. This condition killed many fish and destroyed their food supplies. Fingernail clams, an important food source for fish, had disappeared from the river above Beardstown. About 1940 the mussel industry on the Illinois River collapsed, both from a switch to plastic buttons in the market and from the declines in mussel populations. The decline of the commercial fishing industry has continued, until in 1978 only 306,016 pounds of fish were harvested, a loss of 98% of the record 1908 harvest. Although in recent years the water quality of the Illinois River has been improving, and fish and mussel populations have increased slightly since 1982, other factors continue to keep populations low. The spread of agricultural and urban development has resulted in the clear cutting of forests, the plowing of steep-sloped lands, the straightening of rivers through channelization and the reduction of floodplain through the construction of levees, pavements, and buildings. These actions have caused increased erosion, sedimentation, and flooding. As a result bottomland lakes, which are essential fish production areas, have been filling up with sediment, and other aquatic and shoreline habitats have also been seriously degraded. In addition, barge traffic has resulted in wave turbulences that scour shorelines and river bottoms preventing the growth of vegetation used by some fish for food and disturbing fish spawning areas.

The commercial fish and mussel resources have both been seriously degraded by pollution and sedimentation. A list of possible courses of action to help increase fish and mussel populations of the Illinois River basin follows:

- o Provide positive and forceful action to resolve the problem of sedimentation in our rivers;
- o Fund research projects designed to alleviate environmental problems associated with dredging, barge fleeting, channelization, and other such activities at a cost of \$100,000 per year;
- o Encourage the funding of stream habitat creation and improvement projects at the Department of Conservation at \$100,000 per year;

- o Adopt a statewide greenways concept along major rivers, and
- o Encourage the purchase of floodplain and leveed lands for re-establishment of terrestrial and aquatic habitat.
- o Expand fish contaminant monitoring programs to improve the State's ability to advise the public on suitability of commercial fish taken from the Illinois River for human consumption.

ARCHAEOLOGICAL, HISTORICAL AND PALEOBIOLOGICAL RESOURCES

The study of archaeological, historical and paleobiological resources provides a unique and unrenownable perspective on the natural and cultural history of the Illinois River Basin. In addition to their considerable scientific value, these resources are significant for their educational value, and they provide popular tourist attractions. Clearly their conservation is in the interest of Illinois' citizens.

Unregulated land modification and shoreline erosion are destroying sites at an unprecedented rate. Although adequately protected where federal undertakings are concerned, many state actions impact sites without adequate assessment of these resources. Without prudent management, the present trend in site destruction will continue, and the public will lose its opportunity to learn about the cultural and natural heritage of Illinois.

The following courses of action for the management and development of archaeological, historical and paleobiological sites are recommended.

The Illinois State Museum (ISM) and Illinois Historic Preservation Agency (IHPA) must:

- o Compile, summarize, and evaluate existing records of sites in the Illinois River Basin. This will require \$15,000 for one year.
- o Integrate existing information about cultural and paleobiological resources in the Illinois River Basin into an overall management plan to protect and develop these resources. ISM and IHPA will require \$30,000 for one year.
- o Inventory archaeological sites, standing structures, and paleobiological sites in areas inadequately surveyed. ISM and IHPA will require \$500,000 per year for 5 years.
- o Nominate eligible archaeological and historical sites for inclusion on the National Register of Historic Places. This will require IHPA funding at \$30,000 per year for 5 years.
- o Collaborate with other management agencies to a) identify factors affecting the preservation of cultural and paleobiological resources and b) participate in studies to measure the impact of factors affecting these resources. IHPA will require \$30,000 per year for 5 years.
- o Implement pilot studies to monitor and protect significant sites. IHPA will require \$100,000 per year for 5 years.

- o Establish state historic preservation laws modelled after existing federal legislation to insure adequate protection of significant cultural and paleobiological sites. IHPA will require \$30,000 per year for one years.
- o Develop some significant sites for tourism and the education of Illinois' citizens. IHPA and ISM will require \$500,000 per year for 5 years.

Economic Development

The Department of Commerce and Community Affairs administers a wide variety of programs designed to assist communities, as well as individuals to improve opportunities for economic development in Illinois. Cooperation among business, government, labor and individuals is the key to the success of the Illinois economy. The wide range of services geared to promote economic development and improving the quality of life, through grants to communities, loans to businesses and job training programs to individuals, is helping to create economic activity which puts more Illinoisans to work.

The Build Illinois Program enables the Department to integrate its programs with other state, local and federal programs to capitalize on economic development opportunities and to prepare the state's economic infrastructure for the future. The Department of Commerce and Community Affairs' Build Illinois programs include: Corridors of Opportunity; Large Business Loan; Infrastructure Development; Small Business Loan; and Incubator Development. These programs have been implemented throughout the state, as well as in counties bordering the Illinois River. For this purpose, the projects located in the Illinois River counties are mentioned.

ILLINOIS RIVER BASIN ACTION PLAN

SPECIAL REPORT NO. 11

OF THE

ILLINOIS STATE WATER PLAN TASK FORCE

October 1987

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TABLE OF CONTENTS

MAIN REPORT

Action Plan Introduction	41
Governor's Conference on Illinois River Management	41
Sedimentation	52
Erosion Control	67
Flooding	82
Water Quality	90
Aquatic Habitat, Forestry, Wildlife, and Natural Areas	101
Lake Michigan Diversion	114
Recreation	122
Commercial Navigation	129
Drinking Water Supply	138
Wastewater Disposal	142
Hydropower	145
Agriculture	153
Urban Stormwater Management	161
Commercial Fish and Mussel Resources	168
Archaeological, Historical, and Paleobiological Resources	174
Economic Development	180

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ACTION PLAN INTRODUCTION

This is a report from Illinois State agencies operating through the Water Plan Task Force. It deals with management of the Illinois River and its watershed, and it responds to grass-roots concerns for the basin, as expressed by an April 1-3, 1987 conference and its published proceedings.

This report summarizes the expressed problems and priorities of the April conference as reported in the Proceedings "Management of the Illinois River System: The 1990's and Beyond", as well as sponsorship and planning events leading to the conference. The conference was also designated "A Governor's Conference", and Governor Thompson attended on the first day and cruised Peoria Lake. It was also announced that the Governor had requested the State Water Plan Task Force to review the Conference Proceedings and prepare a recommended action plan.

The body of this report consists of 16 issue papers covering the important topics of concern. These constitute the requested action program of solutions in response to the concerns raised at the April conference.

An Executive Summary of the report is intended for widespread public circulation for information and as a basis for discussion leading to refinement of the proposed action programs.

Governor's Conference on Illinois River Management

An indication of the widespread concern for future management of the Illinois River and its watershed is that the Governor's Conference in Peoria on April 1-3, 1987 was sponsored by more than 50 organizations. These represented local, regional, state, and federal agencies; a wide variety of resource and environmental organizations; and industries.

Planning for the conference began with a meeting of representatives from 34 organizations who met on September 12, 1986. A planning committee of 22 people met on several occasions to develop and formalize the program.

Approximately 250 people attended the conference in Peoria on April 1-3, 1987. The conference was divided into three subject areas dealing with (a) physical and engineering aspects, (b) natural resources and biological, and (c) economic aspects. Within each of the subject areas state of the art papers were followed by discussions in 11 workshop groups. Each of the workshops under a chairman and reporter sought a consensus on the problems and their relative priorities. Possible solutions were also identified.

Welcomes and Keynote Addresses

The conference was opened by Dr. Glenn E. Stout, Director of the University of Illinois Water Resources Center and Conference Chairman, who outlined the nature of the meeting. The mayor of Peoria and the chairwoman of the Peoria County Board welcomed the participants and pledged their support in working toward solutions of the water resource management problems of the basin.

The first keynote speaker drew upon historical and global examples to illustrate the consequences of neglect of adequate water resources management with emphasis on erosion and sedimentation. He stated that scientists, engineers, and the political leaders know the problems and a range of solutions, but are uncertain of priorities with respect to the numerous other problems of society.

The second keynote speaker is Director of the Center for Research in Water Resources at the University of Texas. He drew upon experience with active state leadership in programs for Texas, and emphasized the importance of coordination. He stated that "Texas has learned to give more attention to improved management of its existing water supplies. It is apparent that more benefit can accrue from existing water resources than many have thought possible."

The final keynote speaker was from the Office of the Assistant Secretary for Water and Science in the U.S. Department of the Interior. She spoke of the trend away from centralized government in Washington toward increased emphasis on state and local authority and responsibility. She reviewed recent legislation and current cost sharing. She also spoke of integrated systems management and illustrated this with an example of innovative water management. She concluded by saying that "it is especially auspicious" that the present conference grew from leadership at the local level.

A Historical Background on the Illinois River

A number of speakers began with a geological, engineering, or ecological background to their paper. Actually such background knowledge is essential to an understanding of the complex problems of the Illinois River and its watershed.

A concise background statement follows as taken from the abstract of the conference paper by Dr. Stephen P. Havera of the Illinois Natural History Survey.

Historically, the Illinois River was one of the most productive rivers in North America, its fish and wildlife populations virtually unequaled. Today, even after experiencing drastic changes brought about by human intervention, the Illinois River remains our state's most important river system. Its basin and tributaries total 32,081 square miles and include over half of the area of

Illinois as well as parts of Wisconsin and Indiana. Accordingly, the Illinois River is affected by and affects the majority of our state's citizens.

Five major changes have been imposed by our society on the Illinois River system since the turn of the century. An appreciable volume of water diverted from Lake Michigan entered the Illinois River in 1900 when the Sanitary and Ship Canal was opened at Chicago. Shortly thereafter, vast quantities of untreated domestic sewage and industrial wastes from Chicago were flushed through the Canal into the Illinois River and away from Lake Michigan, a source of the city's water. Thirty-eight organized drainage and levee districts and three private levees were developed for agricultural purposes between 1902 and 1929, and they greatly modified the hydrology and landscape of the valley. Six dams--five along the Illinois and another below its mouth at Alton on the Mississippi--were constructed during the 1930's to create a channel 9 feet in depth for commercial navigation. In recent decades, sedimentation has dramatically affected the river and its adjacent waters.

Sedimentation, today's major pollutant of our nation's agricultural waterways, is the primary obstacle in preserving some semblance of the historic Illinois River for future generations. Restoration of portions of the river valley by reclaiming selected drainage and levee districts is one plausible approach; however, any alternative must be accompanied by a land-use policy that is both economically sound and ecologically intelligent.

Physical and Engineering Aspects

The following sections continue the summary of inputs from papers and discussion at the Peoria Conference. Emphasis in these summaries is placed on those problems of greatest perceived severity.

Commercial Navigation - The State of Illinois offers a distinct geographic and economic advantage to shippers due to its midwest location at the confluence of the Great Lakes and the inland waterway system. Therefore, the subject is of great importance, yet it does not constitute a major problem calling for immediate action programs to correct serious problems. It is also true that although state and local governments have roles to play, considerable responsibility for the management of commercial navigation resides with the federal government.

Management of the Illinois River system requires an understanding of barges, fleeting, and tows; the role of ports, dams, and locks; and the economics of navigation and competing rail and truck transportation.

Perhaps of greatest importance is the necessity to operate the navigation mode in harmony with other resource values of the river so that environmental values are maintained.

Lake Michigan Diversion - High water levels on the Great Lakes with widespread flooding and shoreline erosion and damage has again renewed interest in increasing the diversion from Lake Michigan to the Illinois River among other possible responses. The International Joint Commission is currently studying these options.

Most readers are familiar in a general way with the long history of diversion into the Illinois River which currently is limited to an average of 3200 cubic feet per second (cfs). Any modification in this rate will require a change in the current U.S. Supreme Court order or an Act of Congress.

The most recent information on the impacts to Lake Michigan and the Illinois River is a 5-year Corps of Engineers study completed about 1981. It concluded that during a dry year diversion could be increased to approximately 8700 cfs on an annual average basis, while during a wet year the increased diversion would be only about 5000 cfs.

It is the opinion of the Division of Water Resources that any federal legislation calling for an increased diversion at Chicago should contain the following key elements:

1. Any authorization for an increased diversion at Chicago should be part of a recommended plan of action between Canada and the U.S.
2. The recommended plan of action should include all existing control measures which can be used to reduce water levels on the Great Lakes. This includes not only an increased diversion at Chicago but also stopping or curtailing the diversion of water into Lake Superior at Long Lake and Ogoki, maximizing flows out of the Niagara River and the Welland Canal, including increasing the flows to the Black Rock Lock during the non-navigation season.
3. The recommended plan of action should be implemented only during periods of high lake levels.

It is too early to predict what Congress might do in response to the problem of high water levels on the Great Lakes. The International Joint Commission is expected to complete an interim report this August on existing measures which can be implemented to reduce the adverse consequences of high water levels. Included in their report will be a discussion on increasing Illinois' diversion. One of our most important tasks is to continue to collect information on the potential impacts of an increased diversion and to work with the Corps of Engineers in drafting a revised operating plan so that if an increased diversion is authorized, Illinois' interests are adequately protected.

River Forecasting - It is clear that efficient management of all aspects of the Illinois River system requires advance knowledge of flow conditions. This is termed river forecasting, which involves the application of numerous precipitation and river measurements in a hydrologic model. Usually it is possible to produce accurate forecasts for 24 hours in advance, and accuracy declines for longer periods with little ability beyond about three days.

River forecasting is the responsibility of the National Weather service. For the Illinois basin hydrologic data from manual and remote observations are collected through their offices at Peoria, Springfield, and Chicago. The office at Chicago is responsible for issuing river warnings and statements for public release, but it receives guidance from the River Forecast Center at Minneapolis where the actual forecasts are produced.

River forecasting for the Illinois River is not easy because of the large basin size and variability. The slopes vary from flat to rolling, and the land use from urban to cultivated and forested. For these and other reasons the forecasts have at times been less precise than desirable or possible. Improving the forecasts through enlarged data networks or greater agency attention may be a problem to consider.

The Flooding Problems - Discussion at the April Conference confirmed that flooding remains a serious problem in the Illinois River basin. Since 1978, the Illinois River has flooded at least once a year, and was severe enough to be declared a disaster area in two or more counties in 1979, 1982, 1983, 1985, and 1986.

Flood insurance claims paid since 1978 exceed \$26 million. From this it is estimated that federal and state disaster assistance was \$50 million. Adding the cost of lost business and other expenses brings the cost of Illinois River flooding during the period 1978-1985 to over \$200 million or more than \$25 million per year.

The available approaches to reducing flood losses are well known and were described to the conference attendees. These approaches are outlined briefly in the following paragraphs.

Flood control measures keep water from getting to damageable property. They are often called "structural" measures because they involve construction of man-made structures such as levees and floodwalls, reservoirs and detention basins, channel improvements, control gates and back-up valves, and terracing and runoff controls. Each has its advantages and disadvantages and appropriate applications.

Rather than keeping water off the land, property protection measures modify the buildings exposed to damage. Included in this category are building relocation or acquisition, raising a building, or floodproofing by sealing the walls and closing all openings. Included in this category is flood insurance, which although it does not reduce flooding, does help the flood victim.

Emergency services are primarily to protect people, and include flood warning, sandbagging, evacuation and rescue, and public health and safety maintenance.

Floodplain management measures focus on the future, and are designed to keep the problems from getting worse by ensuring that future development does not increase the flood damages. Usually included in this category are planning and zoning, development regulations, open space acquisition or easements, stormwater system management, erosion and sediment control, and stream maintenance.

It seems clear that a full menu of alternative measures are available and administrative procedures are clear. What seems necessary is a resolve on all levels to devote adequate resources to adopt and implement program to reduce the large, annual flood losses.

Chicago Region Impact - The greater Chicago area represents one of the largest urban centers in the United States, with a population of over five million people in an area of about 900 square miles. Obviously, such a population concentration and the attendant industrial and commercial enterprises require a complex and extensive water quality management program. It may be equally clear that even with extensive controls and treatment, the Chicago area location at the head of the basin, will have numerous impacts on the Illinois River downstream.

The principal water management agency in the Chicago area is the Metropolitan Sanitary District of Greater Chicago (MSDGC). Its actions over the past 100 years are cited here in the briefest fashion, but they have been so innovative, extensive, and effective that there appeared to be no division at the Peoria conference between upstream and downstream interests. A more complete accounting of the MSDGC history and activities is contained in the Proceedings of the conference.

The District was created in 1889 to protect the source of the city of Chicago's drinking water which is Lake Michigan. Although earlier steps were taken, reversal of the Chicago River to dilute the waste load and direct it down the Illinois waterway in 1900 was an early and truly major feat. Through the subsequent years congressional and court actions resulted in changed diversion and dilution, and the level of waste treatment continued to be improved. Today, the diversion is limited to 3200 cfs, and sewage receives at least secondary treatment. The District maintains programs of stream aeration, land disposal of removed solids, and control of industrial waste.

A major problem of the Chicago area has resulted from the combined sewers. During storm periods runoff mixed with untreated sewage frequently exceeded the system capacity, resulting in both basement and local street flooding. Excessive storm flows require the release of polluted waters to Lake Michigan, threatening the water supply and bathing beaches. A solution to this problem is being implemented in the Tunnel and Reservoir Plan (TARP). When completed, this tunnel system of

110 miles, with pipe diameters of 13 to 33 feet which is 240 to 300 feet below ground will intercept, transport, and store the combined flows so that they can be treated before release.

TARP was divided into two phases of which the first phase will reduce the BOD load by approximately 85 percent, and Phase II by 99.8 percent. Phase I will reduce floodwater damage by 10 to 15 percent and Phase II by about 65 percent.

The MSDGC maintains an extensive system of monitoring on the waterways and Lake Michigan. It conducts a considerable program of research to find ways of improving its treatment and other programs.

Natural Resources and Biological Aspects

The Illinois Department of Conservation is a major agency in the natural resources and biological areas. Its mission is to protect and manage the State's natural resources and provide outdoor recreation opportunities. The Department has major interests in the Illinois basin which contains some of the State's most productive fish and wildlife habitats and important outdoor recreation assets. It manages 29 separate properties along the Illinois River encompassing over 70,000 acres of land.

The Departments' interest extends beyond the land it manages to problems of water pollution, erosion, and land use which influence the overall environment. It is conducting an inventory of wetlands, and it supports research on such problems as streambank erosion and aquatic vegetated areas to decrease shoreline erosion.

Fish and Wildlife - Aside from aesthetic values of fish and wildlife, there are important economic considerations. The Illinois River and its backwaters provide about 2.1 million angling days. Based on an average of \$12 spent by fishermen per day this amounts to \$25.2 million annually. In 1985 over 1.0 million pounds of carp, buffalo, catfish, drum and other commercial species were harvested from the Illinois River with a wholesale value of \$276,000. In addition, 741 tons of mussels worth \$402,000 were taken.

Hunting and trapping also contribute to the Illinois River economy. Peak fall migrations often exceed one million ducks on the River. It is estimated that waterfowl hunters expended a total of \$4.6 million in 1985. Deer hunters in counties along the Illinois River spent an estimated \$2.6 million. Small game hunters spent \$6.8 million. The value of furs is estimated at \$800,000 for the 1984-85 season.

Thus the Illinois River continues to be a valuable economic resource despite the number of negative impacts to water quality. Of these, excessive siltation has been termed the number one pollution problem. Suspended silt affects the ability of bass, bluegill, and crappie to feed. Deposited silt also smothers fish eggs in the spawning habitat.

The erosion problems which produce silt will be discussed separately. In addition to silt the river is impacted by a variety of industrial pollutants, and by municipal sewage which can reduce oxygen levels and cause fish kills. Agricultural chemicals, both fertilizers and pesticides have caused a variety of problems.

Water Quality - Many will be surprised to learn that on an organic waste load basis, the Illinois is in the best condition of more than 100 years. Carbonaceous waste loads have been reduced 91 percent since 1922, and in the Peoria area there has been a 97 percent reduction in organic waste discharges since 1925. This has been achieved by municipal and industrial treatment, particularly during the past 15 years. Reductions in the Chicago region through treatment and the TARP program are particularly notable.

Reductions in the organic loadings result in improved levels of dissolved oxygen (DO) which raises the aesthetic quality and the environment for desirable aquatic life. The DO's in the upper waterway above Peoria have increased steadily from near zero conditions in 1922 to values persistently above 5 mg/l presently. Some undesirably low concentrations occasionally occur in localized areas and near zero levels often occur above Lockport, but overall, a tremendous improvement has been evident.

The potential for further reductions in organic waste loads is limited. Therefore, physical factors which influence DO will have greater influence. These include such possible steps as increased Lake Michigan diversion, hydropower development, increased dam aeration with gates, and increased pool elevations.

Soil Erosion - A number of Illinois River management problems point to erosion and siltation as a serious problem. The nature and source of the erosion problem is documented in the Proceedings of the Peoria Conference and in various other sources. It is established that the bulk of erosion products is from crop land in the form of sheet, rill, and gully erosion. A variety of means for reduction of erosion are available through conservation methods. Streambank erosion has more recently come to be recognized as an important source of erosion products at least in some areas. Methods for control of streambank erosion have been suggested.

Active erosion control programs date back to about 1934, but progress has been slow. Currently, programs for the Illinois basin are striving to reach "T by 2000". These are levels of soil loss that can be permitted but still maintain long-term productivity of the soil resource. Such levels would also eliminate many of the off-site problems which have been cited. Unfortunately, mid-course checks indicate that the programs to achieve T by 2000 are behind schedule.

Innovative Ideas for Water Management - In contrast to conventional approaches to waste treatment and discharge of drainage and flood waters,

closed systems are proposed by some. Used water can be sent through the natural cleansing systems of soil, plants, air and sunshine for reclamation and reuse.

A closed land treatment system at a facility will typically include a gravity sewer collection system, deep aerated lagoon pretreatment, a storage lagoon, disinfection, irrigation of turf and landscaped areas during appropriate seasons, and monitoring wells.

Several examples of such closed systems which are located within the Illinois basin were described and discussed.

Demographic and Economic Aspects

Since the stream systems of the Chicago area form the headwaters of the Illinois River system, Cook County is included here among the 21 counties immediately adjacent to the Illinois River.

Population and Personal Income - With the 5,212,000 persons in Cook County the region contains 55 percent of the State's population. Cook County is nearly 100 percent urbanized, while Morgan, Tazewell, Peoria, La Salle, and Will counties are also heavily urbanized.

The region accounted for 56 percent of the State's total personal income, with the largest share in Cook County. Per capita personal income ranges from a high of \$14,328 in Grundy County to a low of \$9,409 in Schuyler County. These compare with a state average of \$13,705.

Agriculture and Industry - The region is an important agricultural area with livestock receipts of \$419,875,000 or 18 percent of the states' total. Crop receipts were \$1,001,739,000 or 17 percent of the states' total.

The region is an important industrial area with about 58 percent of the construction and manufacturing employment of the state. Transportation and public utility employment is concentrated in the region with 64 percent of the state total. Wholesale, retail, finance, and service industries are also heavily concentrated in the region. Travel income is very significant in Cook, Tazewell, Peoria, La Salle and Will counties.

Peoria: A Model Development - Life in early Peoria was oriented to the river as settlers arrived and grain and other products were shipped. Great breweries and distilleries, as well as other industries prospered by the water. Eventually industrial growth virtually closed public access to the river.

In more recent times circumstances permitted the city of Peoria to acquire 37 acres of riverfront property with support from a state grant. Combined with other property the city now controls about 1 1/2 miles of land along the river.

A plan for the property was developed with three areas, one of which is to be a riverfront drive. Two separate areas are planned for high density use with office buildings and retail shops. Other areas will include green space and a marina.

It is of critical importance to the riverfront development that Lake Peoria remain an attractive and open body of water. If siltation were to convert the area to mud flats the reason for the development would be lost.

Priorities and Recommendations

The Peoria conference was structured so that each technical session presenting papers was followed by workshops divided into eleven groups. These were provided with a moderator and reporter, and the following four discussion topics:

1. List problems dealing with the management of the Illinois River.
2. Prioritize the above problems.
3. Which of these problems need immediate action.
4. Identify means to resolve these problems.

Dr. Bill Mathis of Bradley University carried out the heroic task of consolidating responses to the four questions from the eleven groups. For present purposes questions one and two can be combined to show a consensus of top priority problems as:

1. Soil erosion and siltation
2. Flooding
3. Lack of public awareness
4. Diversion of Lake Michigan

Some 33 additional problems were sufficiently discussed to be reported in the Proceedings. There was a consensus that all the top problems require immediate action. With regard to means to resolve these problems, attention was directed first to organizational frameworks. These included focused bodies varying from steering committees to an authority with taxing power. Demonstration projects by existing agencies and strong leadership from the Governor's office were asked.

As to the question of who pays the bill, opinions included taxes at all levels of government, user fees, tax incentives, and cost sharing.

Recommendations - The statement of recommendations suggested by the conference leadership is brief, and is repeated here in its entirety:

1. The formation of a post-conference advocacy committee to set goals, objectives, determine a time frame for action,

and attempt to estimate costs. This committee would also maintain contact with regional planning commissions and with those legislators that were present at the conference and offer suggestions for legislative action through them.

2. Interact closely with state and federal agencies that deal with the management of the Illinois River Systems and its environmental condition, e.g. Illinois Environmental Protection Agency, Department of Energy and Natural Resources, Department of Conservation, Department of Agriculture, Department of Transportation, Corps of Engineers, U.S. Geological Survey, etc.
3. Organize an annual event to exchange information on solving problems, but choosing the site of the meeting at other prominent cities or places along the river, e.g. Joliet, Starved Rock, Havana, Beardstown, Pere Marquette State Park, etc.
4. Continue to focus media attention on the Illinois River system.

SEDIMENTATION

INTRODUCTION

Erosion and sedimentation are natural processes that can be neither stopped nor eliminated. Human interventions can and will accelerate both of these processes, resulting in diminished capacity and use of the receiving bodies of water. These processes are impacting all the rivers and streams in Illinois, including the Illinois River. The lower portion of the Illinois River from above Henry to Grafton, Illinois, occupies a valley that was the home of the Mississippi River before the Wisconsinan glaciation occurred. This former Mississippi valley inherited by the Illinois River was broadened and deepened by the pre-Wisconsinan glacial melts, which had substantially larger flows than the present flow of the Illinois River. Thus the normal flows of the Illinois were unable to transport all the sediment delivered to the river by its tributaries. Because of this altered morphology associated with glacial sediment deposits within the large valley, accelerated sediment deposition occurred all along the Illinois River, especially within the reaches of the river from Peoria Pool to the river mouth near Grafton. The gradient of the river at this location is extremely small (0.17 ft per mile), which also accelerates the deposition of sediment on the river bottom.

In addition to these natural events and morphology, human interventions have also accelerated the sedimentation of the Illinois River valley. Early in the 1900s, the bottomland areas of the Illinois River were in fairly pristine condition. However, when the Sanitary and Ship Canal was opened in 1900 and Lake Michigan water was diverted through the Illinois Waterway, the structure and morphometry of the Illinois River changed permanently. This changed regime eventually increased the average water depths of the river, with an associated increase in sediment deposition within the floodplain areas. Moreover, during this early period (1909 to 1922) many drainage districts were formed, especially below Peoria Pool, and the river lost most of its floodplains to agriculture. Starting around the 1930s, locks and dams were constructed all along the river to maintain a minimum water depth of at least 9 feet. This human intervention again permanently altered the river-floodplain interactions. Many of the original marsh areas became open water areas, only to experience substantial sedimentation due to slack waters created by the dams. The open waters created by the dams thus started to fill with sediment, which initiated their destruction process. Moreover, starting around and after World War II, intense row cropping became the common practice, altering the land use and land cover of the Illinois River watershed. This change of land use substantially increased the gross erosion rate of the Illinois River watershed.

The Illinois River thus has experienced both natural and manmade constraints that have resulted in higher than average sedimentation rates. Almost all the alterations have been permanent in nature and are irreversible. Investigations and evaluations of these problems by researchers from the Illinois Department of Energy and Natural Resources have shown that the river has changed drastically but that some alternative solutions can be implemented to revitalize some sections and reaches of the river and its backwater lakes.

BACKGROUND

Sedimentation of the many backwater lakes, side channels, and sloughs along the Illinois Waterway has been a chronic problem for many years. Construction of hydraulic structures has increased this problem, especially in and around the backwater areas. Sedimentation of the waterways has been instrumental in transforming some of the reaches of the river from a lake-like appearance (because of locks and dams) to a fairly narrow and incised river-like appearance. Many other reaches of the river may attain this fate in the next 30 to 50 years if no drastic measures are taken.

Capacity losses of most of the manmade lakes in Illinois are shown in Figure 1. Capacity losses of some of the major lakes are also given in this histogram for comparative purposes. An examination of this figure shows that the majority of the manmade

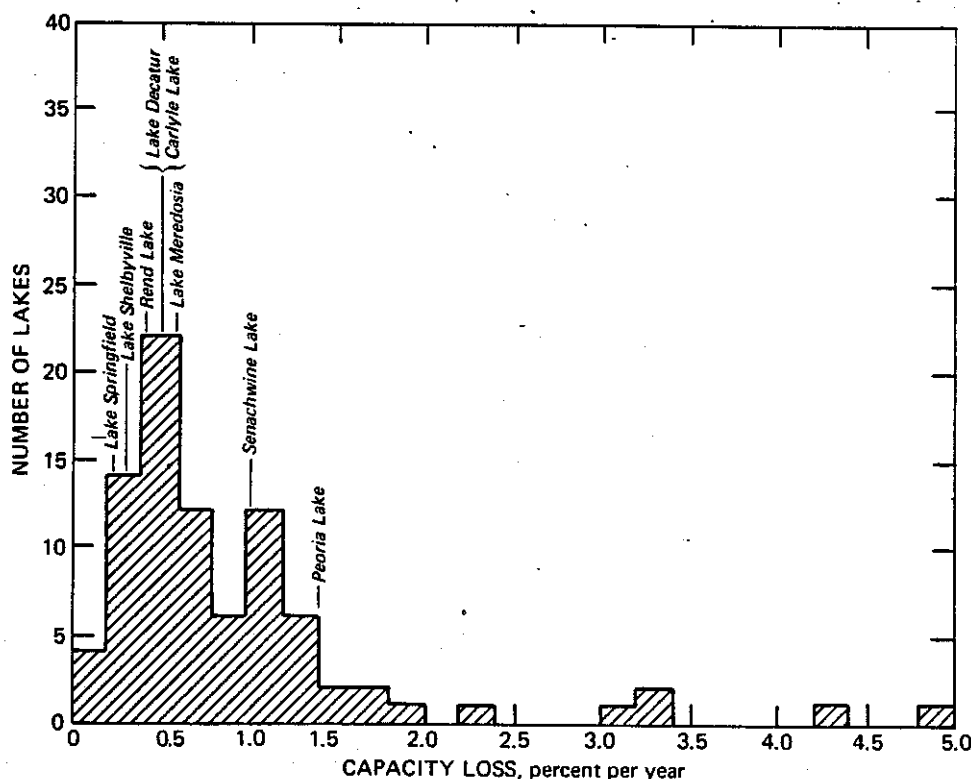


Figure 1. Capacity losses of Illinois lakes.

lakes in Illinois are losing their capacities at the rate of about 0.5 percent per year. However, the two backwater lakes (Lake Meredosia and Senachwine Lake) and Peoria Lake shown on this figure have substantially higher sedimentation rates than Illinois reservoirs. This observation is true for most of the backwater lakes along the Illinois River. Thus a general comparison between manmade lakes on the tributary streams and the backwater lakes is not always feasible even though the physical processes of the sedimentation are essentially identical.

For most backwater lakes with a distinct low-water connection to the Illinois River, the loss of capacity starts from the mouth of the lake near the connecting channel and then proceeds progressively toward the main water body of the lake. Such an example is shown in Figure 2 for Lake Meredosia. The distinct formation of a delta at the river-backwater interface is quite evident here, and it is suspected that the lake has lost much more capacity since this photograph was taken in 1968. Technology is now available to retard the sedimentation of such backwater lakes where a defined connecting channel is present.

Sedimentation of waterways reduces aquatic habitats, impedes the operation of commercial navigation and recreational traffic, constricts the conveyance channel, and transforms these water bodies into wetlands and mudflats. Many riverfront communities may ultimately face the prospect of losing their access to the water except through small dredged channels.

A number of research projects that have been completed by researchers from the Illinois Department of Energy and Natural Resources (ENR) and other agencies are now discussed.

ACTIVITIES, PROGRAMS, AND STUDIES

The three Illinois Scientific Surveys -- State Water Survey, Natural History Survey, and State Geological Survey -- have been active in studying and evaluating the Illinois Waterway for many years. Research has been conducted on bank erosion and erosion control, effects of navigation on resuspension and transport of sediment to the channel border areas and side channels, sedimentation of backwater lakes, sedimentation and potential solutions for Peoria Lake, sediment sources, and quality of the deposited sediment. Some of these research projects are still being carried out by ENR researchers.

Bank Erosion and Navigation Impacts

An evaluation of bank erosion of the Illinois River showed that at many locations the Illinois River has severe bank erosion problems. A detailed evaluation of 20 bank erosion reaches showed that the bank erosion is caused by the movement of water and actions of waves. These physical forces in conjunction with the geotechnical characteristics of the bank materials determine the amount and



Figure 2. Mouth of Lake Meredosia at the Illinois River.

potential of bank erosion. It is estimated that about 70 to 75 percent of Illinois River banks are impacted by erosion caused partially by wave action.

Illinois State Water Survey researchers with the cooperation of the Department of Conservation and Department of Energy and Natural Resources are at present investigating low-cost bank stabilization techniques within the Court Creek and Crow Creek watersheds. Sediments and nutrients contributed by bank erosion to the total suspended loads of these creeks are being determined to evaluate the effectiveness of these low-cost streambank stabilization techniques.

The objectives of these projects are to reduce the bank erosion of small- to medium-sized tributary streams, which will ultimately have a cumulative impact on sediment delivery to larger streams and rivers. Restoration of vegetative covers and attendant increases in aquatic habitats in these stream corridors are other significant benefits of these streambank stabilization techniques.

In addition to the sediment that is normally carried to the side channels and backwater lakes by the flowing river water, the physical action of commercial navigational traffic also can resuspend and transport sediment in a lateral direction. Research has shown that the ambient sediment concentration of the Illinois River can be increased by as much as 10 to 15 percent by the repeated movement of barge traffic. Tow passages can maintain an increased suspended sediment concentration for as much as 60 to 90 minutes, and the effect of tow passages on the elevated sediment concentration is more pronounced near the channel border areas and in restricted channels, especially during low-flow periods.

Backwater Lakes

Sedimentation of backwater lakes was investigated by DENR researchers. Impacts of sedimentation on aquatic habitats along the Illinois River, sediment transported by the Illinois River, and sedimentation of Peoria Lake have also been investigated. As of 1975, there were approximately 53 backwater lakes along the Illinois River with a combined surface area of 54,173 acres. The locations of some of these backwater lakes are shown in Figure 3. Initial evaluation of the backwater lakes has shown that about 15.4 million tons of sediment are deposited over the entire floodplain of the Illinois River. Most of the backwater lakes experience an average depth loss of 0.1 to 1.0 inch per year.

Research results indicate that the sedimentation of the backwater lakes is not an isolated problem and that it extends all over the basin. Figure 4 shows some typical cross sections selected from seven backwater lakes along the Illinois River. These cross sections show that as of 1975 many of the backwater lakes had lost significant amounts of depth to sediment deposition. As of 1987, many of these cross sections are probably completely full of sediment. Cross section 3 for Lake Meredosia (Figure 4) is just outside of the delta shown in Figure 2.

Except for recent sedimentation data for Peoria Lake, no new data on the sedimentation rates of these backwater lakes have been collected since around 1979. However, an attempt was made on the basis of the old data to estimate the present capacity of 15 backwater lakes and bottomland areas of the waterway. These data are shown in Table 1. Apparently many of these bottomland basins may now be no more than broad mudflats with no appreciable water bodies. For all practical purposes, some of these lakes should no longer be called backwater lakes.

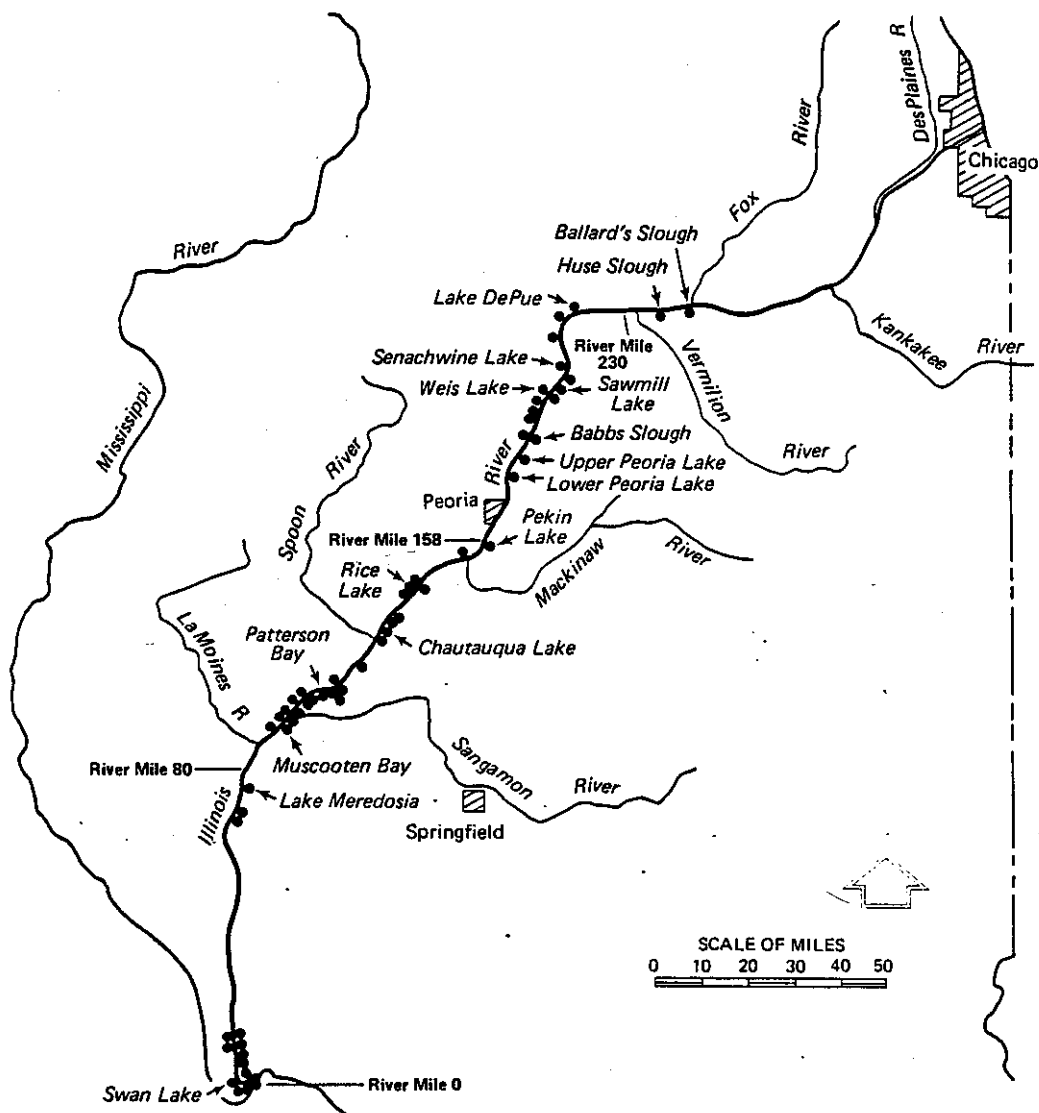


Figure 3. Backwater lakes along the Illinois River, River Miles 0 to 230.

Peoria Lake

A considerable amount of interest and public awareness has been generated on the question of the sedimentation problems of Peoria Lake. Recent research by Water Survey researchers has been instrumental in bringing this problem to full public scrutiny and discussion. Peoria Lake is the largest and deepest bottomland lake in the Illinois River valley. This lake is the remnant of the much larger glacial river that used to occupy this valley. Shifting of

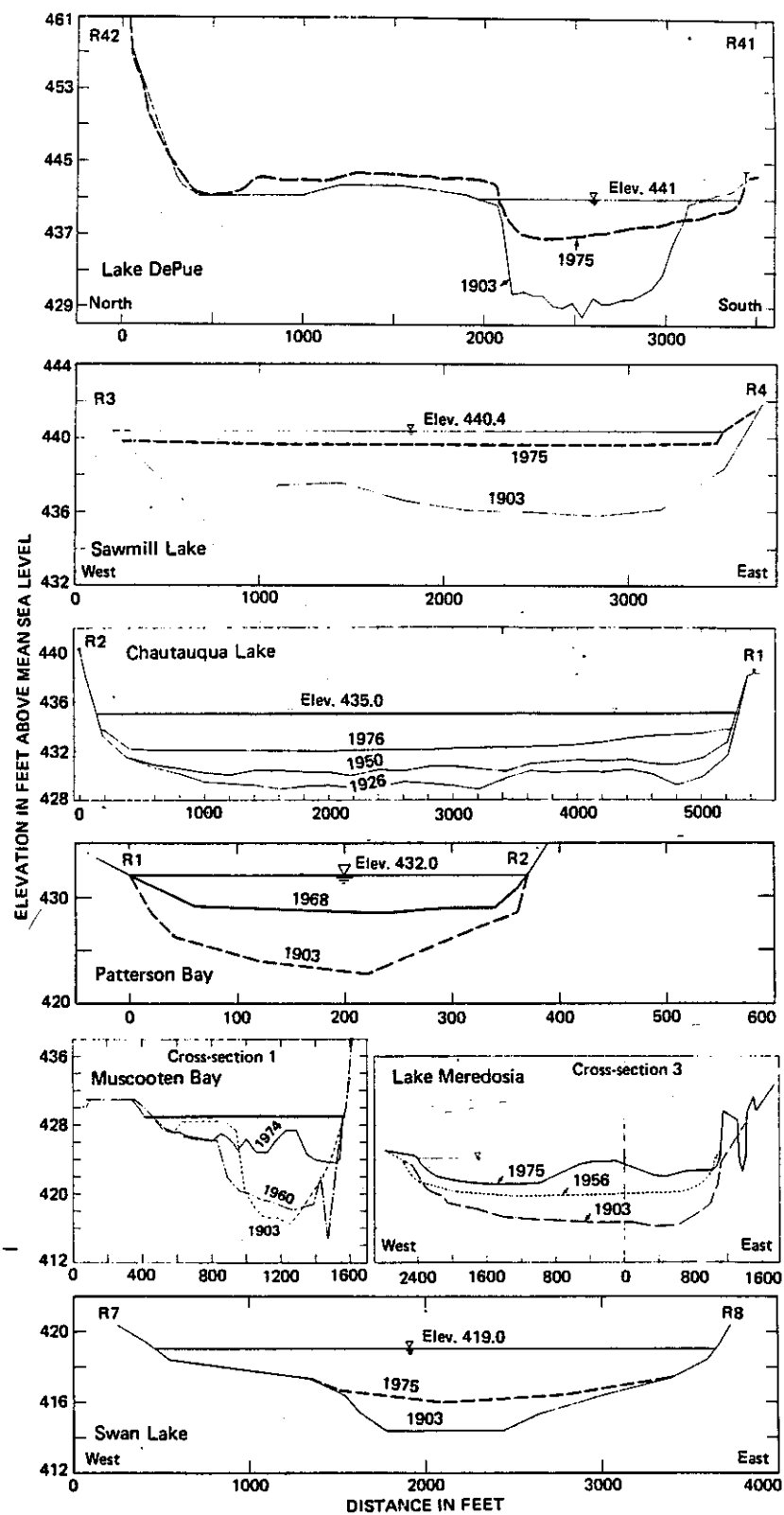


Figure 4. Typical cross sections of backwater lakes along the Illinois River.

Table 1. Sedimentation of the Backwater Lakes
Along the Illinois Waterway

percent	Pool	Lake	River mile	Sedimen- tation rate (in./yr)	Capacity (acre-ft)		Estimated capacity (acre-ft)	Accumulated sediment (acre-ft)	capacity loss
					1903	1975	1985		
	Alton Pool	Swan Lake	5	0.38	4,853	2,783	2,501	2,352	48
		Lake Meredosia	72	0.43	7,791	4,207	3,709	4,082	52
	La Grange Pool	Muscooten Bay	89	3.12	1,459	184	-0	1,459	100
		Patterson Bay	107	0.31	271	165	5	266	98
		Chautauqua Lake	125	0.33	14,293	11,679	10,778	3,515	25
		Rice Lake	133	0.32	3,064	1,119	849	2,215	72
		Pekin Lake	153	0.08	323	226	212	97	30
	Peoria Pool	Peoria Lake	162	0.82	120,000	56,600	38,300	81,700	68
		Babbs Slough	185	0.26	1,377	625	521	856	62
		Weis Lake	191	0.30	450	110	63	387	86
		Sawmill Lake	197	0.47	2,110	381	141	1,969	93
		Senachwine Lake	199	0.30	9,240	2,468	1,527	7,713	83
		Lake DePue	203	0.59	2,837	778	492	2,345	83
		Huse Slough	221	0.96	253	51	23	230	91
	Marseilles Pool	Ballard's Slough	248	0.91	142	36	21	121	85

the old glacial river resulted in the sluggish flow of the river, which could neither transport nor shift the sediment brought by its tributaries. Two of the main tributaries to Peoria Lake, Farm Creek and Ten Mile Creek, deposited their sediment load at their confluences with the Illinois River, forming large alluvial deltaic deposits. These deltas essentially constricted the flow of the Illinois River, forming two distinct pools presently known as Upper and Lower Peoria Lakes. These constrictions, when associated with the increased low water depths due to the construction of locks and dams, have accelerated the sedimentation of Peoria Lake.

The lake has not only lost about 68 percent of its 1903 capacity but has also been transformed into an incised navigation channel near its upper reaches. If the navigation channel is excluded, the capacity loss of the lake would be close to 78 percent of its 1903 capacity. An evaluation of the sedimentation rates has also shown that the rate of loss has increased substantially since 1965, and it is suspected that Upper Peoria Lake will lose most of its capacity outside the navigation channel by the year 2000.

This dramatic change in the Peoria Lake planform is illustrated in Figure 5. This figure shows the changes in the areal distribution of the 5-foot-deep contour line within Peoria Lake from 1903 to 1985. As can be seen, at the present time the river has more than 5 feet of water mostly at or near the navigation channel. The sedimentation is obviously worse in Upper Peoria Lake than in Lower Peoria Lake. This is also shown in the four cross sections at River Miles (RM) 164, 168, 175, and 179. Obviously the cross section at RM 179 is at present nothing but a reflection of an incised river with most of its channel area besides the navigation channel filled with sediment. This area has essentially turned into a mudflat.

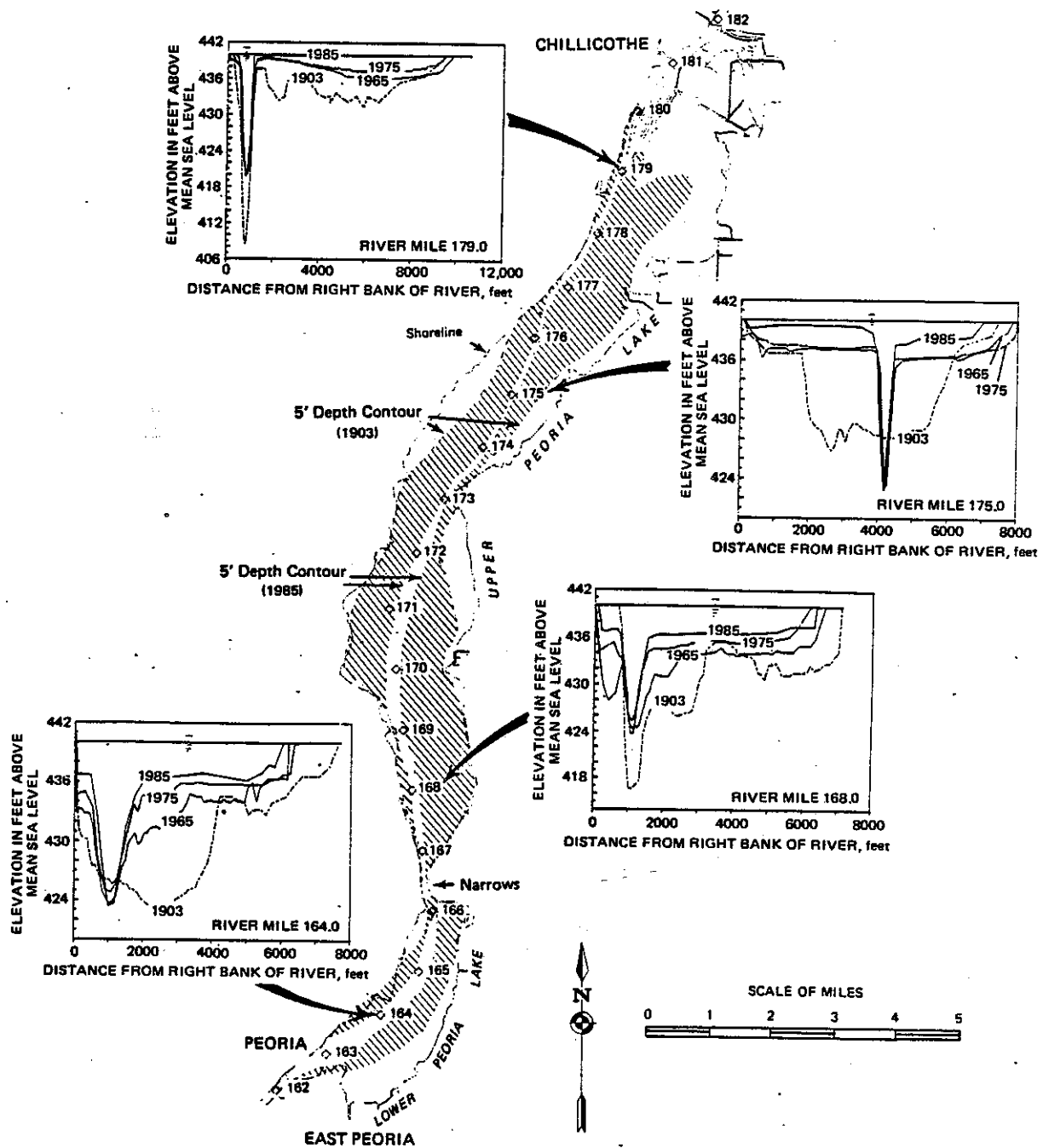


Figure 5. Changes from 1903 to 1985 in the amount of Peoria Lake area with depth greater than 5 feet.

These cross-sectional profiles can also be used to demonstrate the future planform of the lake and other lakes with similar sedimentation problems. It is quite obvious that the cross section at RM 175 will look similar to the cross section at RM 179 in the very near future, and so on for the cross sections at RM 168 and 164. Similar fates also await other cross sections down the river, including those in Lower Peoria Lake. Thus these cross sections not only give a historical perspective on the past sedimentation rates of the lake but also provide a look at the future condition of the lake.

Sediment Sources

The sediment load of the Illinois River is greater than that carried by the Mississippi River. Soil particles eroded from the watershed and the streambanks are transported to the river; however, not all the soil particles that are eroded from the watersheds are delivered to the river. An evaluation by Water Survey researchers has shown that about 27.6 million tons of sediment is delivered annually to the Illinois River from all of its contributing delivery points. According to this evaluation, about 38 percent of this sediment is generated within the bluff areas and the other 62 percent comes from the upland areas.

Analyses of the deposited sediments at various backwater lakes indicate that for the most part this sediment is composed of equal amounts of silt and clay with insignificant amounts of sand. Thus the major sources of these deposited sediments are the upland areas, especially the agricultural watersheds of the river. However, at a few tributaries and at certain locations such as those at the Court Creek research site, field measurements show that during flood flows about 50 percent of the stream sediment load comes from localized bank erosion sites. A similar percentage has been estimated for other midwestern streams where bank erosion rates are extremely high.

The investigation of the sedimentation of Peoria Lake has shown that about 60 percent of the sediment deposited within the lake comes from the main stem of the Illinois River and the other 40 percent of the sediment load is contributed by the streams draining directly into Peoria Lake. Of this 40 percent, about 2 to 3 percent is contributed by the bank erosion of Peoria Lake.

It should be pointed out that most of the sediment in the Illinois River is transported as suspended load and about 5 to 10 percent of the total load is transported as bed load. Most of the suspended load (approximately 90 percent) is composed of silt and clay, again indicating that the source of this sediment is upland watersheds, especially those close to the river where the travel time is extremely small compared to that from distant points on the watershed.

A sediment budget of the entire Illinois River valley has been made on the basis of data generated by Water Survey engineers. Research shows that about 7 million tons of sediment is delivered annually by the Illinois River to the Mississippi River at Grafton.

On the other hand it has been estimated that 27.6 million tons of sediment is delivered to the Illinois River. Therefore it can be estimated that 20.6 million tons of sediment is deposited annually within the Illinois River valley. If it is assumed that this sediment is spread out uniformly over the entire water surface areas for the maximum overflow conditions of the river (233,700 acres), then the average sedimentation rate is 0.81 inch per year with the unit weight of the sediment assumed to be 60 pounds per cubic foot. However, in general this entire area would not be flooded on an annual basis. Thus if it is assumed that on the average only the river and bottomland lakes are flooded (89,700 acres), then the average sedimentation rate would be about 2.10 inches/per year. Since some of the sediment is deposited within the immediate floodplain areas, the average sedimentation rate of the Illinois River bottom would lie somewhere between 0.81 inch and 2.10 inches per year.

Sediment Quality

Research conducted by Water Survey and the Geological Survey scientists on the quality of the deposited sediment along the Illinois River valley has shown a trend of generalized improvement in the quality of the deposited sediment. The sediment layer deposited since the 1970s is generally of better quality than the sediment deposited in the 1950s or 1960s. Plots of lead and zinc concentrations in deposited sediment from Peoria Lake show a gradual but certain decrease in concentrations since around 1960.

This trend of decreased concentrations of inorganic compounds in the deposited sediment has been demonstrated all along the river valley. Figure 6 shows a plot of arsenic distribution along the river, in which the concentrations of arsenic for the top, middle, and bottom layers of sediment are shown. At most locations, the arsenic concentration in the top layer is smaller than the concentration in the middle layer. Similar variations for other compounds such as aluminum, chromium, lead, and zinc were also observed. These variations indicate that the input of inorganic compounds to the Illinois River has decreased in recent years and that the top layers of the sediment are less polluted than the middle layers which were deposited in the 1950s and 1960s.

Alternative Solutions

Sediment delivered to the Illinois River can be controlled at or before the "input" point or can be managed within the lakes and bottomlands once it has been delivered and deposited within this environment. Concepts and ideas for the revitalization of the backwater lakes were postulated as far back as 1950 in a report for the Illinois Department of Conservation and again in 1969 in another report by the Illinois Division of Waterways. The 1950 report indicated that some of these backwater areas should be managed as conservation lands and others should be converted to become part of the main river. The 1969 report also outlined a plan to manage the.

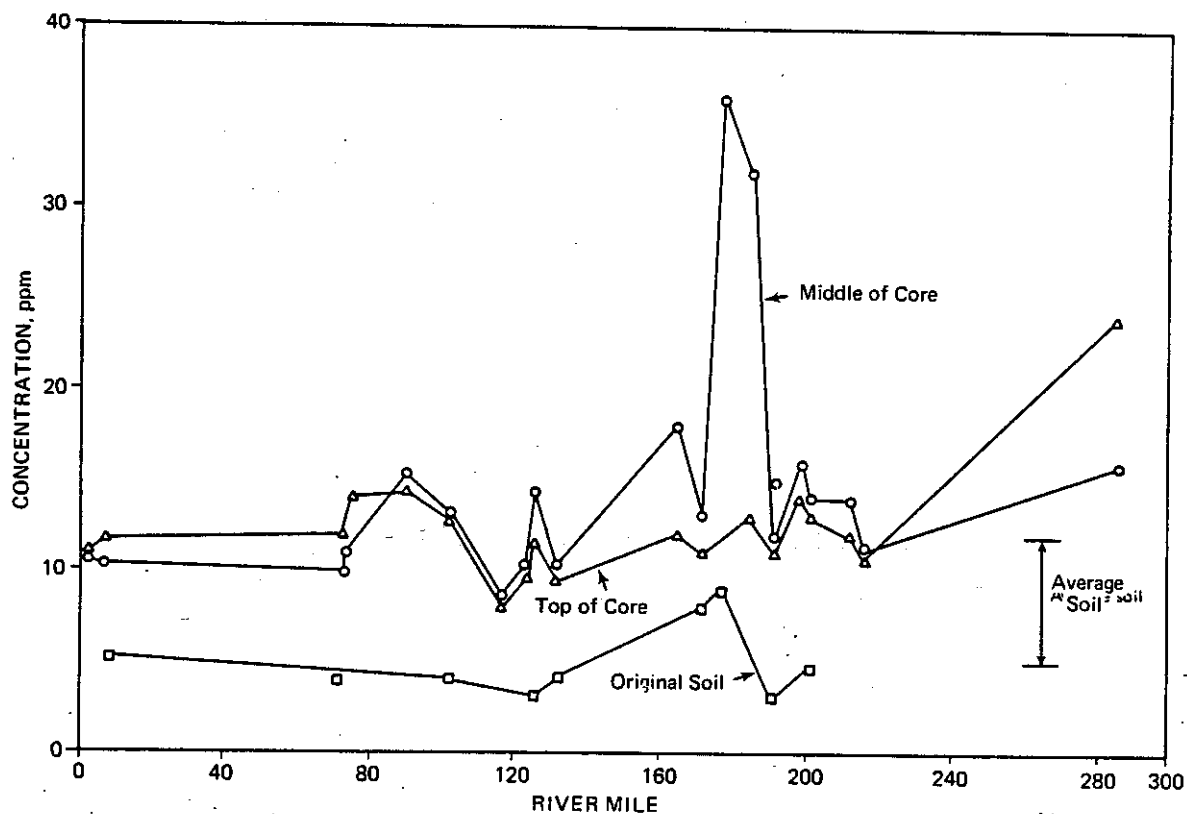


Figure 6. Arsenic distribution in sediments of lakes along the Illinois River.

backwater lakes. However, no positive actions were taken to implement the recommendations outlined in these two reports.

A number of possible and probable alternative solutions for the revitalization of Peoria Lake were outlined in a 1985 Water Survey report. Many of those alternatives should be applicable for other backwater and bottomland lakes. Various alternatives that could be applicable are control of sediment input from tributary streams that drain directly into the backwater lake(s); control of sediment from the Illinois River watersheds through the use of best management practices; conversion of some of the drainage and levee district areas into their original floodplain status; establishment of bank protection measures including those presently in use in the Court Creek watershed; reduction of bank erosion by establishment of marsh plants or use of wave reduction techniques, as is presently being attempted in Peoria Lake by the Water Survey; construction of detention basins to reduce sediment loads; removal of sediment by dredging, especially in selected high-use areas; construction of artificial islands with dredged materials (similar to the Water Survey research project presently being conducted for Peoria Lake); manipulation of the locks and dams either to dry and compact the

deposited sediment or to alter the navigational patterns to cause resuspension and transport of some of the deposited sediment; isolation of some of the areas of backwater lakes for revitalization by dredging; use of some areas of the backwater lakes to recreate wetlands; structural alteration of the locks and dams to increase low water depths; and finally, obviously, "doing nothing" and letting nature decide its future courses of action, turning the backwater and bottomland lakes into marshes, wetlands, and uplands.

POSSIBLE COURSES OF ACTION

Before a course of action is recommended, it must be pointed out that the Illinois River cannot be returned to its original pristine condition. Moreover, some areas of the bottomlands and backwater lakes have undergone almost irreversible changes and can not be altered or revitalized without significant cost and effort. It is essential that a thorough evaluation of the backwater and bottomland lakes be made to determine the area or areas of these resources that are of significant value to Illinois citizens. Once this determination has been made, efforts should be concentrated to revitalize only these high-value areas.

The recently completed Governor's Conference on the Illinois River has identified siltation as the number one problem facing the Illinois River. The following recommendations were developed after consideration of this and other research reports evaluated for this issue paper.

The recommended "courses of action" are divided into two broad categories: resource information and plan of action.

I. Resource Information: Basic information is essential in the development of any management alternative if we hope to have any long-lasting impact. The following resource information is needed:

- o Estimated sedimentation patterns of the backwater lakes are given in Table 1. A sedimentation survey of these selected backwater lakes will provide information about the present state of these lakes. Sedimentation surveys of the backwater lakes will require \$175,000 per year for three years and these funds should be made available to the Illinois State Water Survey (ISWS), Department of Energy and Natural Resources (DENR). A centralized data bank where physical, chemical, and biological data and information are stored and updated periodically will not only assist us in developing proper management alternatives, but will also enhance our ability to respond to critical issues that will face us during extreme events such as droughts and floods. Cost of this program will be \$75,000 per year and the program should be housed at the ISWS (DENR).
- o Extremely limited amounts of data and information are presently available on sediment loads carried by streams and rivers that drain directly into the Illinois River. State

natural resources agencies should initiate and support a program of in-stream sediment load measurements including the quality of sediment at selected gaging stations on the tributaries and main stem of the Illinois River. This program would be housed at the State Water Survey (DENR) and would complement the Benchmark Sediment Network presently operated by the Water Survey. This course of action is similar to actions recommended by the State Water Plan Task Force in their Special Report 10 of August 1985. Annual cost for such a program for the State would be \$325,000 with an additional first year's cost of \$110,000 for the initiation of the program.

II. Plan of Action: The "plan of action" is subdivided into three subheadings: Peoria Lake sediment management, in-lake management, and sediment input control. In-lake sediment management will have immediate impacts or benefits, and sediment input control will probably start to show an impact on the receiving lakes within the next 5 to 10 years. Intelligent meshing of "in-lake sediment management" with "sediment input control" is essential to obtain long-lasting benefits for all the backwater lakes, including Peoria Lake and the backwater lakes along the Illinois River. This plan of action also includes demonstration projects that can be initiated easily.

Peoria Lake Sediment Management:

- o The state natural resources agencies under the leadership of the Illinois State Water Survey (DENR) should work with local area interests to develop a comprehensive management program for Peoria Lake consistent with the recommendations made in the "Peoria Lake Sediment Investigation" report published by the State Water Survey. This activity will require \$250,000 and these funds should be made available to ISWS (DENR).
- o The state natural resources agencies should continue to pursue Corps of Engineers' FY89 environmental management program funding for the island demonstration project in Peoria Lake. Present estimated cost of this program by the U.S. Army Corps of Engineers is \$3.3 million. If this project is funded by the Environmental Management Program of the Upper Mississippi river, 25% of the total cost must be cost shared by the State and local agencies. Lead agencies for this program would be IDOC and DENR.

In-Lake Management:

- o High-use areas within the backwater and bottomland lakes should be identified by the state natural resources agencies and local concerned officials and citizens. A comprehensive management plan should be developed for these backwater and bottomland lakes. Total cost would be \$500,000 for a period of three years.

- o Techniques should be developed and implemented for the removal of sediment by selective dredging. Research should be conducted by DENR (ISWS, INHS, ISGS) and the estimated cost for this activity is \$100,000 per year for 3 years.
- o Concepts should be developed and feasibility studies should be conducted for creating artificial islands (similar to those now being studied by the Water Survey for Peoria Lake), public parks, playgrounds, etc., in the immediate vicinity of the dredging sites with dredged materials. Estimated cost for such an activity would be \$100,000 per year for 2 years.
- o Techniques should be identified and developed for controlling the sediment input to selected backwater lakes from the Illinois River by using gated control structures. Research for feasibility studies will be needed and should be conducted by ISWS (DENR) and will cost \$75,000 per year for 2 years.
- o Management techniques should be developed and implemented so that some or portions of the backwater lakes can be managed as marshes, wetlands, and terrestrial habitats. Such work should be undertaken by the State natural resources agencies.

Sediment Input Control:

- o Low-cost bank stabilization techniques should be developed and implemented for streams located within the immediate vicinity of the river and backwater lakes. ISWS (DENR) and IDOC should be the lead agencies and annual costs would be \$200,000.
- o Best management practices should be implemented on the highly erodible areas of the watershed. For cost estimate, see "Erosion Control" issue paper.
- o The public must be made aware that a state permit is required for stream channel modification or floodway construction.
- o IDOT- Division of Water Resources permit requirements will include provisions to reduce erosion and preserve stream channel stability.
- o Concerned state agencies should work with local units of government to encourage the incorporation of streamside vegetative buffers for all new and existing developments in both rural and urban areas.
- o Any state or federally funded projects on waterways, streams, rivers, lakes, or wetlands should be reviewed by the state natural resources agencies for determination of their potential impact on the erosion and sedimentation of the concerned bodies of water.

EROSION CONTROL

INTRODUCTION

The overwhelming majority of those persons in attendance at the Peoria Conference recognized soil erosion and siltation from land alterations as the primary problem affecting the Illinois River System.

The 51 soil and water conservation districts who are included wholly, or in part, within the Illinois portion of the Illinois Drainage Basin have, since their creation, been responsible for all activities relating to the application of conservation practices on agricultural lands. With the adoption of the State's T by 2000 Plan in 1985, efforts conducted by soil and water conservation districts, the Soil Conservation Service, and the Illinois Department of Agriculture were increased in the area of erosion control. The T by 2000 plan also led to a commitment from the State for 20 million dollars over a 5 year period for cost-sharing with farmers for the application of soil conserving practices.

The purpose of this paper is to summarize activities being conducted by the Soil and Water Conservation Districts, Illinois Department of Agriculture, and the USDA Soil Conservation Service in addressing soil erosion and siltation/sedimentation concerns.

BACKGROUND

The Illinois River Basin contains 18,048,000 acres, of which 15,646,100 acres are contained within Illinois' boundaries. Cropland acres accounted for 10,402,900 of which 29 percent, or 3,498,700 acres exceed soil loss tolerance rates. "T" or soil loss tolerance, is the level of soil loss that can be permitted but still maintain long term productivity. "T" values in Illinois range from 1 to 5 tons per acre. Table 1 provides a comparison of soil losses by land use for sub basins within the boundaries of Illinois for the Illinois River drainage basin.

TABLE 1
ACRES IN SOIL LOSS GROUPS BY LAND
USE FOR EACH WATER RESOURCES COUNCIL
HYDROLOGIC UNIT IN THE ILLINOIS
RIVER SYSTEM (ACRES x 100)

<u>WRC Unit</u>	<u>Soil Loss</u>	<u>Cropland</u>	<u>Pasture</u>	<u>Forest</u>	<u>Minor</u>
07120001	<T	2907	178	102	76
	T-1.5T	688	0	0	0
	1.5T-2T	205	0	0	0
	2T-4T	450	0	0	0
	>4T	89	0	0	0

<u>WRC Unit</u>	<u>Soil Loss</u>	<u>Cropland</u>	<u>Pasture</u>	<u>Forest</u>	<u>Minor</u>
07120002	<T	4881	293	201	132
	T-1.5T	1410	0	0	14
	1.5T-2T	362	0	0	0
	2T-4T	379	0	0	0
	> 4T	63	0	0	13
07120003	<T	178	218	110	39
	T-1.5T	49	0	0	0
	1.5T-2T	25	0	0	0
	2T-4T	64	0	0	0
	> 4T	60	0	0	0
07120004	< T	1036	621	224	197
	T-1.5T	244	0	0	0
	1.5T-2T	202	0	0	0
	2T-4T	291	0	0	0
	> 4T	232	0	0	0
07120005	< T	4152	181	51	91
	T-1.5T	556	0	0	0
	1.5T-2T	194	0	0	0
	2T-4T	176	0	0	0
	> 4T	64	0	0	0
07120006	< T	757	301	106	248
	T-1.5T	173	0	21	0
	1.5T-2T	92	0	0	0
	2T-4T	185	0	0	0
	> 4T	52	0	0	0
07120007	< T	3549	165	133	126
	T-1.5T	734	0	0	0
	1.5T-2T	246	0	0	0
	2T-4T	449	0	0	7
	> 4T	67	0	0	0
07130001	< T	4695	366	271	64
	T-1.5T	1855	0	0	0
	1.5T-2T	635	0	0	0
	2T-4T	896	0	0	0
	> 4T	93	0	0	0
07130002	< T	5239	261	125	178
	T-1.5T	1526	0	21	0
	1.5T-2T	381	0	0	0
	2T-4T	452	0	0	0
	> 4T	174	0	0	0

<u>WRC Unit</u>	<u>Soil Loss</u>	<u>Cropland</u>	<u>Pasture</u>	<u>Forest</u>	<u>Minor</u>
07130003	<T	3599	469	726	140
	T-1.5T	996	0	0	18
	1.5T-2T	115	0	0	0
	2T-4T	351	0	0	0
	>4T	63	0	0	0
07130004	<T	3266	172	84	57
	T-1.5T	1649	0	0	0
	1.5T-2T	616	0	0	0
	2T-4T	537	0	0	0
	>4T	156	0	0	0
07130005	<T	4710	613	285	135
	T-1.5T	1032	0	0	17
	1.5T-2T	533	0	0	0
	2T-4T	727	0	0	0
	>4T	160	0	0	0
07130006	<T	4508	384	215	58
	T-1.5T	1543	0	0	0
	1.5T-2T	484	0	0	0
	2T-4T	369	0	0	0
	>4T	102	0	0	0
07130007	<T	4955	248	135	132
	T-1.5T	730	0	0	0
	1.5T-2T	148	0	0	0
	2T-4T	332	0	0	0
	>4T	37	0	0	0
07130008	<T	2865	158	166	26
	T-1.5T	508	0	0	0
	1.5T-2T	196	0	0	0
	2T-4T	165	0	0	0
	>4T	63	0	0	0
07130009	<T	6748	332	60	184
	T-1.5T	2058	19	0	0
	1.5T-2T	508	0	0	0
	2T-4T	802	0	0	0
	>4T	107	0	0	0
07130010	<T	3113	550	198	56
	T-1.5T	920	7	0	0
	1.5T-2T	260	0	0	0
	2T-4T	428	0	0	5
	>4T	55	0	0	0

<u>WRC Unit</u>	<u>Soil Loss</u>	<u>Cropland</u>	<u>Pasture</u>	<u>Forest</u>	<u>Minor</u>
07130011	<T	4735	567	488	86
	T-1.5T	1557	38	0	0
	1.5T-2T	547	0	0	0
	2T-4T	1058	0	0	0
	>4T	147	0	0	0
07130012	<T	3149	294	72	52
	T-1.5T	536	0	0	27
	1.5T-2T	183	0	0	0
	2T-4T	331	0	0	0
	>4T	65	0	0	0

Erosion rates on the acreages in the proceeding table yield an estimated 83,372,600 tons of gross erosion each year.

Illustration 1 is a map of the state which shows the locations and numbers of the WRC Hydrologic Units.

Table 2 summarizes gross erosion for the entire drainage basin within Illinois.

TABLE 2
GROSS EROSION BY HYDROLOGIC UNIT
WITHIN THE ILLINOIS RIVER BASIN

<u>Upper Illinois Sub Basins</u>	<u>Area (acres)</u>	<u>Gross Erosion (tons)</u>	<u>Tons/Acre</u>
07120001	570,200	2,523,500	4.43
07120002	823,300	3,758,000	4.56
07120003	348,300	1,390,000	3.99
07120004	815,900	3,980,600	4.88
07120005	634,600	3,128,500	4.93
07120006	408,200	2,146,400	5.26
07120007	697,800	3,571,200	5.12
Sub Total	4,298,300	20,497,700	4.77
<u>Lower Illinois Sub Basins</u>	<u>Area (acres)</u>	<u>Gross Erosion (tons)</u>	<u>Tons/Acre</u>
07130001	1,295,400	7,152,700	5.52
07130002	842,100	4,146,500	4.92
07130003	986,900	4,812,900	4.88
07130004	722,000	3,703,200	5.13
07130005	1,171,400	6,973,000	5.95
07130006	921,100	4,717,100	5.12
07130007	721,100	4,104,300	5.69
07130008	599,600	3,215,900	5.36

Lower Illinois Sub Basins	Area (acres)	Gross Erosion (tons)	Tons/Acre
07130009	1,190,000	6,220,400	5.23
07130010	860,300	5,277,100	6.13
07130011	1,423,300	8,377,700	5.89
07130012	614,600	4,174,100	6.79
Sub Total	11,347,800	62,874,900	5.54
TOTAL	15,646,100	83,372,600	5.33

Soil Erosion and deposition of sediment into the Illinois River System is a natural process that has been accelerated by land altering changes brought about by man. Intensive agriculture, land clearing and urban construction, drainage of wetlands, levee construction and alteration of stream segments in the Illinois River drainage basin have significantly increased the rate of erosion and the amount of sediment entering stream tributaries, and the Illinois River. Illinois State Water Survey studies indicate that about 27 million tons of eroded soil enter the Illinois River each year. Of that amount, about 15 million tons remain in the channel and in backwater areas in the form of deposited sediment. To further compound the sedimentation problems, the construction of locks and dams has created an artificial water level, slowing water velocity and allowing more sediment deposition into the wider and slower pool areas. The dams in fact, act somewhat like sediment traps.

Since erosion and sedimentation is a natural process it can never be eliminated completely. It can, however, be reduced if soil conserving practices are installed on agricultural land in the watershed, and other steps are taken to control streambank and construction site erosion. In recent years, high fuel costs and a generally depressed farm economy have had a somewhat beneficial impact on soil erosion and the resulting sedimentation. Farmers have been forced to implement cost saving measures to maintain solvency. Many of those measures have included fewer tillage passes over the field, leaving greater amounts of crop residue, thus shielding the soil surface from the erosive effects of rainfall and rainfall runoff.

The continuation of row cropped corn and soybeans however, will allow erosion to continue at rates above "T" levels on erosion prone slopes. Reduction of erosion rates to "T" levels on the sloping soils will require the installation of one or more structural soil conservation practices or, in many cases, removing the land from the rotation and putting it to less intensive use.

ACTIVITIES, PROGRAMS, AND STUDIES

The Illinois Department of Agriculture (IDOA) is the State agency with responsibility for soil conservation on rural, agricultural lands in the State. IDOA is a partner in erosion control efforts, with the 98 local soil and water conservation districts (SWCD's), and the

U.S.D.A. Soil Conservation Service, as well as other State and federal agencies. The Erosion and Sediment Control Program which is administered by IDOA, was adopted by the Department and SWCD's in 1982. The Program established a mechanism through which persons can file a complaint against land which they believe is experiencing excessive erosion. The complaint is then investigated and if found to be valid, the landowner is offered cost-share assistance to install corrective conservation practices.

To date, 138 complaints have been filed but only 70 have received cost-share assistance. Limited appropriations have necessitated funding those complaints on a priority ratio basis of tons of erosion reduced/dollars spent. The enabling legislation requires that financial assistance be made available before any action on a complaint can take place. Therefore, 68 complaints are currently unaddressable. The program contains no penalties and is a voluntary approach to reducing erosion to "T" or tolerable soil loss levels by 2000. To achieve this end, the State provides SWCDs funding for staff and office operations and to share the cost of completing soil surveys. In addition, in FY 1986, FY 1987, and FY 1988, a total of \$12 million has been appropriated under Build Illinois for sharing the cost of installing needed conservation practices with landowners through the Conservation Practices and Watershed Land Treatment Programs.

The 51 SWCD's in the drainage area of the Illinois River have together received \$3,367,381 in cost-share funds under the Conservation Practices Program administered by the Department. A total of \$6 million was distributed on a formula basis to each of the 98 SWCD's in FY 1986, FY 1987, and FY 1988. In addition, another \$6 million was available for cost-sharing conservation practices within a defined watershed area. Under the Watershed Land Treatment Program (WLTP) 32 WLTP projects in 26 SWCD's within the Illinois River Drainage Basin, have been approved to receive a total of \$2,762,411 in fiscal years 1986, 1987, and 1988. Selection of these projects was accomplished through the State Watershed Priority Committee. This Committee, made up of representatives from federal, State and private natural resource related agencies and organizations, is responsible for reviewing, prioritizing and selecting all Illinois watershed projects that are funded through State and federal sources.

The Governor has recommended that \$20 million be made available for soil conservation cost-sharing over a 5 year period. If this appropriation is forthcoming, a total of \$10,846,779 would be available to control erosion in the Illinois River Drainage Basin. Tables 3 and 4 show the dollar amount received by SWCD's to date, and the amount projected over 5 years for the CPP and WLTP programs.

In addition to the Build Illinois cost-share program, other State and federal programs to conserve soil have been initiated in the last couple of years. The 1985 federal Farm Bill includes the Conservation Reserve Program. This is a 5 year program to retire highly erosive land for 10 years or more. In addition, the Farm Bill includes a conservation compliance component that requires all landowners with

highly erodible land to develop and implement a conservation plan to control erosion to tolerable levels by 1995, if they wish to continue to participate in federal farm programs. The Farm Bill and the State's T by 2000 Program will go hand-in-hand in reducing erosion statewide by the end of the century.

TABLE 3
BUILD ILLINOIS EROSION CONTROL COST-SHARE MONIES
RECEIVED OR ANTICIPATED BY SOIL AND WATER CONSERVATION DISTRICTS
IN THE ILLINOIS RIVER BASIN

CONSERVATION PRACTICES PROGRAM

<u>SWCD</u>	<u>FY 1986</u>	<u>FY 1987</u>	<u>FY 1988</u>	<u>Total To Date</u>	<u>5-Year Projected</u>
**Adams	\$ 41,847	\$ 31,385	\$ 52,309	\$ 125,541	\$ 209,235
*Brown	13,219	9,914	16,524	39,657	66,095
Bureau	28,084	21,063	35,105	84,252	140,420
Calhoun	11,451	8,588	14,314	34,353	57,255
*Cass	10,000	7,500	12,500	30,000	50,000
**Champaign	23,059	17,294	28,824	69,177	115,295
Christian	16,108	12,081	20,135	48,324	80,540
**DeKalb	28,295	21,221	35,369	84,885	141,475
*DeWitt	14,497	10,873	18,121	43,491	72,485
Ford	22,219	16,664	27,774	66,657	111,095
*Fulton	28,820	21,615	36,025	86,460	144,100
*Greene	21,116	15,837	26,395	63,348	105,580
*Grundy	10,000	7,500	12,500	30,000	50,000
**Hancock	29,468	22,101	36,835	88,404	147,340
**Henderson	10,855	8,141	13,569	32,565	54,275
**Henry	37,172	27,879	46,465	111,516	185,860
*Iroquois	32,917	24,688	41,146	98,751	164,585
Jersey	19,522	14,641	24,403	58,566	97,610
Kane-DuPage	20,906	15,679	26,133	62,718	104,530
*Kankakee	19,785	8,309	24,731	52,825	98,925
*Kendall	10,000	7,500	12,500	30,000	50,000
Knox	27,156	20,367	33,945	81,468	135,780
Lake	10,000	7,500	12,500	30,000	50,000
*LaSalle	38,345	28,759	47,931	115,035	191,725

<u>SWCD</u>	<u>FY 1986</u>	<u>FY 1987</u>	<u>FY 1988</u>	<u>Total To Date</u>	<u>5-Year Projected</u>
**Lee	21,326	15,994	26,658	63,978	106,630
Livingston	27,997	20,998	34,996	83,991	139,985
*Logan	16,616	12,462	20,770	49,848	83,080
Macon	20,135	15,101	25,169	60,405	100,675
Macoupin	23,585	17,689	29,481	70,755	117,925
*Mar-Put	30,606	22,954	38,258	91,818	153,030
*Mason	10,000	7,500	12,500	30,000	50,000
*McDonough	19,575	14,681	24,469	58,725	97,875
**McHenry	18,087	13,565	22,609	54,261	90,435
*McLean	69,547	52,160	86,934	208,641	347,735
*Menard	12,379	9,284	15,474	37,137	61,895
**Montgomery	14,182	10,636	17,728	42,546	70,910
*Morgan	29,713	22,285	37,141	89,139	148,565
*North Cook	10,000	7,500	12,500	30,000	50,000
*Peoria	22,692	17,019	28,365	68,076	113,460
Piatt	10,000	7,500	12,500	30,000	50,000
**Pike	31,324	23,493	39,155	93,972	156,620
*Sangamon	25,055	18,791	31,319	75,165	125,275
*Schuyler	19,487	14,615	24,359	58,461	97,435
*Scott	10,593	7,945	13,241	31,779	52,965
**Shelby	25,493	19,120	31,866	76,479	127,465
*Stark	17,194	12,895	21,493	51,582	85,970
*Tazewell	22,499	16,874	28,124	67,497	112,495
**Vermilion	25,300	18,975	31,625	75,900	124,500
**Warren	16,966	12,724	21,208	50,898	84,830
*Will-So Cook	28,014	21,010	35,018	84,042	140,070
*Woodford	21,431	16,073	26,789	64,293	107,155
Total	\$1,124,637	\$ 836,942	\$1,405,802	\$3,367,381	\$5,621,185

* SWCD is entirely within the boundaries of the Illinois River Basin.

** Less than one-half of the SWCD is within the Illinois River Basin.

TABLE 4
BUILD ILLINOIS EROSION CONTROL COST-SHARE MONIES
RECEIVED OR ANTICIPATED BY SOIL AND WATER CONSERVATION DISTRICTS
IN THE ILLINOIS RIVER BASIN

WATERSHED LAND TREATMENT PROGRAM

SMCD	WATERSHED	Funds Approved For				Projected				TOTAL
		FY 1986	FY 1987	FY 1988		FY 1989	FY 1990	FY 1991	FY 1992	
Brown	Mt. Sterling Lake	\$ 8,738	\$ 0	\$ 0	\$ 0	\$	\$	\$	\$	\$ 8,738
Brown	Camp Creek	57,500	0	95,600		94,000	92,100			339,200
Brown	Shelby Creek			115,700		124,700	102,100			342,500
Christian	Cottonwood & Locust Creeks	28,000	34,950	55,900		37,300	18,600			174,750
Fulton	Canton Lake	15,000	15,000	20,000						50,000
Greene	Greenfield	20,344	13,106							33,450
Iroquois	Pigeon Creek	58,691	17,436	103,250						179,377
Jersey	East Otter Creek	37,014	27,760							64,774
Jersey	Dow Hill			17,519		20,000				37,519
Kane-DuPage	Mill Creek	55,000								55,000
Knox	Court Creek	85,000	83,206	85,000		85,000	85,000			423,206
LaSalle	Matthiessen Lake	23,500	189							23,689
LaSalle	Crotty Creek	39,308								39,308
Lee/LaSalle	Four Mile Grove Creek			70,969		76,875	70,500	67,406		285,750
Logan	Middle Lake Fork	32,700	16,051	53,852		61,545	23,080	15,386		202,614
McDonough	Vermont Lake	24,000	18,000							42,000

SWCD	WATERSHED	Funds Approved For				Projected				TOTAL
		FY 1986	FY 1987	FY 1988		FY 1989	FY 1990	FY 1991	FY 1992	
McHenry	Dutch Creek	1,369								1,369
Macon	North Oakley	48,225	58,500	98,325		64,050	34,275			303,375
Macon	Long & Big Creeks			127,500		158,250	171,550			457,300
Marshall-Putnam	Lower Crow Creek	20,000	17,667	25,000		28,557				91,224
Mason	Sleepy Hollow	41,000	40,200	67,600		40,700	23,700			213,200
Macoupin	Palmyra-Modesto	25,500	11,391							36,891
Menard	Cabiness-Grove	5,667	0	19,920		29,620	29,620	29,620	29,620	144,067
Morgan	Jacksonville Lake	28,770	28,798	33,173		33,173	31,631			155,545
Morgan	Waverly Lake	41,450	38,625	35,900		21,625				137,600
Peoria/Marshall-Putnam	Senachwine Creek			21,000		27,465				48,465
Piatt	Upper Sangamon (Goose Creek)	48,600								48,600
Piatt/Champaign	Upper Sangamon River							120,662	96,530	482,650
Sangamon	Lower Sugar Creek	40,000	43,500	80,000		96,530	120,663			323,500
Schuyler	Schuyler-Rush Lake	29,000	49,000	58,000		39,000	20,000			195,000
Tazewell	Dillon Creek	36,000	45,750	61,000		61,000	21,750			225,500
Woodford	Eureka Lake	41,995	17,438							59,433
TOTAL		\$ 892,371	\$ 576,567	\$1,293,473		\$1,184,390	\$ 919,569	\$ 233,074	\$ 126,150	\$5,225,594

CONCLUSIONS

The Soil Conservation Service in Champaign, Illinois, has at the request of the Illinois Department of Agriculture, recently developed some cost estimates for treating the cropland acres exceeding tolerable soil loss in the Peoria Lakes Hydrologic Unit. The cost estimates are based on information presented earlier in this report, primarily: soil loss and acres effected by slope category. In addition, information and the present tillage systems and crop rotations were used to estimate current soil loss and the conservation practices needed to meet tolerable soil loss on this land.

Previous experience in estimating an average number of conservation practices per acre was applied to the Peoria Lakes area. Statewide unit costs for conservation practices installation were used to arrive at the total cost.

Table 5 provides an estimate of the total cost for controlling all types of erosion in the watershed for land that now exceeds "T".

The cost estimate of \$21.4 million outlined in Table 5 is for the Peoria Lakes drainage basin only. It does not address urban runoff controls, in-lake rehabilitation nor the conservation needs or costs for other land areas in the upper Illinois River drainage area. The estimate is only for cropland acres exceeding tolerable soil loss. The cost estimate does not address soil losses from pasture, forestland or urban land uses, nor does it include land that is below tolerable soil loss yet may still be contributing to the sediment problem. In addition, an estimate was not made for streambank or gully erosion along tributaries. There are several different methods of controlling this type of erosion, the variety of which prohibit attaching a cost estimate.

The Peoria Lakes drainage basin accounts for about 41 percent of the Illinois River Basin. No intent is made here to draw a comparison between the costs of protecting the Peoria Lakes Drainage Basin with the remainder of the Illinois River Basin. Rather, this information is to provide a comparison between the amount of funds needed to protect the basin above Peoria Lakes (\$21.4 million) and the amount of State funds that are expected to be expended in the entire Illinois River Basin (\$10.8 million). It is also important to note that even if sufficient funds, staff and landowner cooperation were available to the extent that all erosion on agricultural land could be reduced to tolerable levels, the uncertainty of the sources of the sediment in the Peoria Pool might preclude satisfactory problem abatement.

POSSIBLE COURSES OF ACTION

The annual gross erosion in the Illinois River basin was estimated as 83 million tons. The annual sediment yield delivered to the Illinois River was assessed as 27 million tons and the total annual sedimentation rate in the Illinois River and its backwater lake areas

TABLE 5
CONSERVATION MEASURES AND ESTIMATED COST FOR
CONTROLLING SHEET AND RILL EROSION ON ACRES
GREATER THAN 1 IN THE PEORIA LAKE WATERSHED

ROTATION	TILLAGE	ACRES	GRASS WATERWAY (Ac.)	NEEDED PRACTICES			
				WATER & SEDI- MENT CONTROL STRUCTURE (No.)	TERRACE (Ft.)	GRADE STABILIZATION STRUCTURE (No.)	FIELD BOARDER STRIPS (Ac.)
Corn-Soybean	Chisel/Disk w/30% residue	107,200	670	3,350		70	2,700
Corn-Soybean	Chisel/Disk w/30% residue/contour	105,900	660	3,300		70	2,650
Corn-Soybean	O-Till	95,000	590	2,950		60	2,375
Corn	O-Till	28,100	175	1,050		35	700
Corn-Soybean	Contour	49,400	310	1,625		40	1,250
Corn	O-Till & Contour	3,700	25	150		5	90
Corn-Soybean	Contour/Terraces	3,600			1.1 million		100
Corn	Contour	1,400	10	70		2	50
Total			2,440	12,500	1.1 million	282	9,915
Cost/Unit			\$ 1,770	\$ 1,000	\$ 2.00	\$ 4,000	\$ 150
Total \$ Cost			4,148,000	12,500,000	2,200,000	1,128,000	1,487,250
Total For All Practices			\$21,463,250				

Source - U.S. Soil Conservation Service - April 8, 1987

as 15 million tons. Even though a series of government programs have been initiated to reduce soil erosion in the watersheds and sedimentation and water quality problems in the Illinois River system, the following additional actions are recommended.

- . State cost-share funding for erosion control should be increased and extended beyond the initial five-year authorization period. Estimates indicate that \$160,000,000 will be needed in the next 12 years to meet T by 2000 goals for the Illinois Basin.
- . Soil and Water Conservation Districts will require an estimated \$5,000,000 per year from increased local as well as state sources of revenue to enable the employment of full-time experienced staff to work on the erosion control program.
- . The Illinois Conservation Enhancement Act, approved by the 85th General Assembly, should be adopted and funded at the requested \$10,000,000 level. This bill would supplement the federal Conservation Reserve Program, removing highly erodible land from crop production.
- . The proposed Bureau of Agricultural Development should be created and funded at \$100,000 annually, as a means of providing assistance to farmers in choosing alternative land uses that will keep soil erosion loss at or below "T".
- . Legislation needs to be provided which would provide for assessments at one-sixth of the value for farmers who voluntarily take marginal land out of production.
- . The Illinois Department of Transportation - Division of Water Resources should be provided necessary authority and \$105,000 annually to assure that proper permit authority/management practices are in place to mitigate impacts from stream alteration.
- . A continuous research program should be funded to: (1) define the erosion and sedimentation relationship, (2) determine effectiveness of Best Management Practices for controlling water quality degradation, (3) define critical areas for solving downstream sediment and water quality problems, and (4) define biological and water quality benefits/damages of any sediment control techniques.
- . During the development of conservation farm plans, soil and water conservation districts and the USDA Soil Conservation Service should provide leadership in encouraging riparian landowners to adopt stream corridor protection measures through the use of critical area seeding, vegetative filter strip, and field windbreak practices.

As it was stated, erosion is the source of sedimentation and its related water quality problems. To be effective in solving all the

river basin-related problems, erosion control is not only for conserving soil resources, but also for other off-site benefits. In addition to the implementation program based on standards for performance, a monitoring program based on field measurements at selected fields, watersheds, streams, and lakes should be initiated and funded. This effort will assure that government spending is matched with the actual reduction of soil erosion and sedimentation. Periodic reevaluations of the programs are needed to guide the implementation program towards the goals.

- . A continuous research program should be funded to: (1) define the erosion and sedimentation relationship, (2) determine effectiveness of Best Management Practices for controlling water quality pollution, (3) define critical areas for solving downstream sediment and water quality problems, and (4) define biological and water quality benefits/damages of any sediment control techniques.
- . Interagency coordination in terms of program implementation, monitoring, budgeting, research, technical assistance, and program evaluation are needed.

Installing conservation practices on erosive agricultural lands is a proven method of reducing soil erosion, decreasing sedimentation in rivers, lakes and streams, and ultimately benefiting water quality. Installing enduring conservation practices however, is a very expensive undertaking for the farmer. The farmer must pay property taxes on all of the land he owns. If that land is not producing an income for the farmer, it becomes a burden that, if allowed to increase, will eventually bankrupt him. It therefore becomes necessary for the farmer to produce as much as he can on all of his land at the lowest cost possible in order to earn an income sufficient to sustain himself. Enduring conservation practices such as terraces, grass waterways, water control structures, and others will allow the farmer to pursue maximum production while at the same time controlling erosion on his cropland. The short term benefits to the farmer in controlling erosion on his land however are minimal. Minimal to the extent that few farmers will ever recover the cost of an enduring practice.

Cost-share programs, such as the Conservation Practices and Watershed Land Treatment Programs administered by the Department and Soil and Water Conservation Districts are not a new idea. Federal cost-share programs have been in existence for decades and the State has had its own programs over the years. Conservationists believe however, that without additional information and some types of incentive to make the installation of conservation practices attractive to farmers, the problems associated with soil erosion will not diminish. Conversely, it is expected that erosion related problems will increase in terms of depleting the soil resource base, continued siltation, and further degradation of water quality.

It is of significant importance to the economy of the State that current erosion control efforts be strengthened and that new efforts be identified and pursued to the greatest extent possible.

FLOODING

INTRODUCTION

From its beginning at the confluence of the Kankakee and Des Plaines Rivers, the Illinois River travels 270 miles to its mouth at the Mississippi. On its way, it travels next to 19 counties and 36 cities and villages. Periodically the river leaves its banks and flows through those communities. Indeed, the Peoria Conference established flooding as one of the most serious problems of the Illinois River and its basin.

BACKGROUND

Since 1978, the Illinois River has flooded at least once a year. Floods were so bad that two or more counties along the river were declared disaster areas by the President in 1979, 1982, 1983, 1985, and 1986.

Flood insurance claims paid since 1978 exceed \$26 million, one-half of all the flood insurance claims paid in the entire state. This number can be doubled to estimate total state and federal disaster assistance of \$50 million. State and federal disaster expenditures represent only 1/4 to 1/3 of the total property damages suffered. Adding the cost of lost business and other expenses brings the cost of Illinois River flooding during the period 1978-1985 to over \$200 million or more than \$25 million per year.

The traditional response to Illinois River floods has been to build levees. A trip along the river will show a substantial investment in levee systems protecting urban, industrial, and agricultural areas. Most of these were built with the advice and financial assistance of the U.S. Army Corps of Engineers. However, there are still a tremendous number of properties left unprotected.

Accordingly, we need to look at other solutions. Rather than focus on only keeping the river off of people's property, we need to think in terms of all the possible ways we can protect property from flood damage. The following pages will briefly review the various measures, used in the Illinois River basin where they are appropriate. They are categorized in four general areas: flood control, property protection, emergency services, and floodplain management.

ACTIVITIES, PROGRAMS, AND STUDIES

Flood Control

Flood Control measures keep water from getting to damageable property. They are also called "structural" measures because they involve construction of man-made structures to affect the flow of surface

water. Because of the size and cost of structural projects, they are typically implemented by government agencies, usually with the help of the Division of Water Resources, the Corps of Engineers, or the Soil Conservation Service.

Levees and floodwalls - Probably the most common flood control measure is to erect a wall of dirt (levee) or concrete (floodwall) between the river and the property to be protected. Levees and walls must be well designed to account for large floods, underground seepage, pumping of internal drainage, and erosion and scour.

Larger levees or floodwalls usually cost so much that they cannot be built without government aid. We can afford to spend a lot of money to protect the major concentrations of flooded property like East Peoria and Beardstown. But when the properties are scattered or aligned in narrow strips along the river as in Rome, we cannot afford to build 15 foot high levees to protect them. In fact there is only one more levee project expected on the main stem of the Illinois River, and that will only construct a 44 year levee for the Village of Liverpool.

Reservoirs and detention basins - These measures control flooding by holding high flows behind dams or in basins. After the flood peaks, water is let out slowly in small amounts that the river can handle. The lake created may provide recreational or water supply benefits and dry basins can double as parks or other open space uses.

Channel improvements - A channel can be made wider, deeper, or straighter so it will carry more water and/or carry it downstream faster. Some smaller channels can be lined with concrete or even put in underground pipes. In a few locations, a diversion or overflow channel can speed floodwaters to another, bigger river.

Control gates and back-up valves - Many smaller ditches and pipes can have gates or valves installed to keep water from backing up. Some are operated manually but others, such as "flap gates", can be automatic. This prevents a larger river above flood stage from backing floodwater into tributaries or sewer lines.

Terracing and run-off controls - The run-off of rain water can be slowed down on the ground by vegetation, terraces, contour plowing, no-till farm practices, and other measures. Delaying surface water on its way to the channel also controls erosion and loss of topsoil.

Property Protection

Rather than keep water off of the land, property protection measures modify the buildings exposed to damage. They are also appropriate where the buildings are scattered or a flood study has concluded that a structural flood control project will not be built. For more informa-

tion, see Protect Your Home from Flood Damage, available free from the Division of Water Resources.

Building relocation or acquisition - The surest and safest way to protect a building from flooding is to move it to high ground. Vacant riverfront property can be converted to public park or open space. Because this is expensive and because many people do not want to own vacant flood-prone lots, there are several government programs that can provide financial assistance or even purchase the building and lot. For more information, see Elevating or Relocating Your House to Reduce Flood Damage, available free from the Division of Water Resources.

Building elevation - Raising a building above the flood level is cheaper than moving it and can be less disruptive to a neighborhood. For more information, see Elevating or Relocating Your House to Reduce Flood Damage, available free from the Division of Water Resources.

Floodproofing - Some buildings can be made floodproofed by sealing the walls and closing all openings. When water reaches the building, it is kept out. Another technique, wet floodproofing, works for garages and unfinished areas; water is let in the building but all damageable property is removed or protected. Unlike acquisition or elevation, floodproofing is relatively inexpensive and does not involve moving or making major changes to the building.

Self-help advice and assistance - Some communities provide help in the form of manuals, "open houses", and direct consultation to property owners. Much property can be protected with inexpensive steps taken by the owner such as installing a sewer back-up valve, moving appliances out of the basement, and considering the flood hazard in remodeling projects. Lives and property can be protected when people know the flood warning signals, evacuation procedures, where to get sandbags, how to clean up, etc.

Technical advice is one of the least expensive measures a community can undertake. Every little step taken by a property owner will reduce flood damages. Manuals and technical assistance, including slide presentations, are available from the Division of Water Resources.

Flood insurance - Although it does not reduce flooding or flood damages, insurance does help the flood victim. The National Flood Insurance Program is strongly supported in Illinois, and is administered by the Federal Emergency Management Agency (FEMA). It makes federally subsidized insurance available for properties affected by surface water problems in communities that have enacted floodplain regulations. Some commercial companies sell sewer backup and sump pump failure policies. All are available through property insurance agents.

Emergency Services

While property protection measures protect buildings when the flood comes, emergency services measures protect people. All counties and many communities have Emergency Services and Disaster Agencies (ESDAs) to coordinate warning, response, and recovery during a disaster. The manual, Flood Fighting, available from the Division of Water Resources or the Illinois Emergency Services and Disaster Agency, covers these measures in more detail.

Flood warning - Providing an adequate warning is the number one way to save lives. Furthermore, much moveable property, particularly vehicles, can be protected, even on very short notice. With a well-prepared response plan, critical facilities such as hospitals and water works, can take protection measures and the limited work force can be used most efficiently. Warning systems are relatively inexpensive, especially on the bigger rivers.

Sandbagging - This term includes all emergency barriers that can be erected on short notice to stop flood waters. Generally, emergency barriers are not as effective, and may even cost more than permanent flood control facilities. Sandbagging does work well as a back-up system to other flood protection measures. It can be a very flexible way to provide protection on short notice.

Evacuation and rescue - Removing people from the flooded area, either before the flood (evacuation) or during (rescue), are vital measures to protect lives. A related measure that must be considered is sheltering and feeding those who are forced from their homes.

Public health and safety maintenance - Numerous measures must be taken during a flood to prevent dangers to health and safety. These include patrolling evacuated areas to prevent looting, providing safe drinking water, vaccinating residents for tetanus, clearing the streets, and cleaning up debris and garbage.

Floodplain Management

While the three previous categories of mitigation measures are oriented toward dealing with the existing flood problem, floodplain management projects focus on the future. Floodplain management projects are designed to keep the problem from getting worse by ensuring that future development in the floodplain does not increase flood damages, and by maintaining the river system's capacity.

Planning and zoning - Advance planning can match the land use with the land's hazards, typically by reserving flood hazard areas for open space, parking lots, backyards, or similar low-damage activities. A land use plan that proposes appropriate uses can be implemented by a zoning ordinance that regulates private development and by the com-

munity's capital improvements plan that directs extension of roads and utilities, the location of future parks, etc.

Floodplain development regulations - Subdivision ordinances and building codes come into effect after the plans and zoning ordinances have identified where various land uses are appropriate. If buildings are allowed, these regulations ensure that they will not be subject to flood damage and that the development will not aggravate the flood problem.

Building codes also require that when existing buildings are substantially damaged, they are rebuilt protected from flood damage. In addition to preventing flood problems from getting worse, these regulations qualify a community for participation in the National Flood Insurance Program. For more information, see the Division of Water Resource's manual, Floodplain Regulations.

Open space acquisition or easements - Rather than regulate future development, many communities purchase vacant flood-prone lands to prevent hazardous development and/or to obtain attractive sites for parks. While this can be expensive, there are sources of financial assistance for park acquisition or development. Some Illinois communities have been successful in getting owners to donate land for tax purposes or to ensure it is kept open for future generations to enjoy.

As an alternative to public ownership, an easement can be purchased. With an easement, the owner is able to develop the flood-free portion but he is paid to not develop the flood-prone part. In some cases, the owner is allowed to develop his ground for low hazard uses or he can transfer his right to develop other flood-free parcels.

Stormwater management - In the past, developers and communities built gutters, sewers, and ditches to move surface water as fast as possible downhill to the river channels. Not only did this aggravate downstream flooding, it often overloaded the community's drainage system. The alternative, stormwater management, looks at the whole system and identifies where water should be held on-site, in detention basins, or allowed to flow to the river quickly.

Requirements for detention are generally included in ordinances governing subdivisions and new developments. This insures that new developments pay their share of the cost of using the drainage and river system. Many developments utilize wet or dry basins as landscaping amenities.

Erosion and sediment control - Many Illinois rivers are losing their capacity to carry floodwaters because of sedimentation. As rain hits the ground, especially where there is bare dirt as on farm fields and construction sites, soil is picked up and washed downstream. Sediment tends to settle where the river slows down and will gradually fill in

the channel. Farm practices such as terracing and no-till will help reduce agricultural erosion and keep topsoil where it is needed. Catch basins can be installed downstream of construction sites to slow run-off so sediment will be dropped on-site before it gets to the river.

Stream maintenance - Sediment is not the only thing that restricts a river's ability to carry floodwaters. A stream maintenance program works to clean out blockages of a channel caused by overgrowth and debris. This work is usually done by a community's public works crew. Communities also pass ordinances prohibiting dumping and making riverfront owners responsible for maintaining their areas. For more information, see the Division of Water Resource's manual, Stream Maintenance.

Picking the Best Measures

While some of these measures may appear attractive, the state of Illinois recommends a careful planning process to ensure that the flood damage protection methods chosen are feasible and appropriate to the hazard. Assistance is available from the Division of Water Resources for a three-step planning approach:

1. Reconnaissance. The first step is to collect available data on flooding and survey the affected properties. This may include a detailed building-by-building survey to identify appropriate property protection measures and draw preliminary recommendations. This work is usually done completely at State or federal expense.

2. Detailed plan. The results of the reconnaissance and preliminary recommendations are reviewed with local officials. If there is an interest in pursuing the projects, an intergovernmental agreement will be signed. Typically it will include a requirement that since the state or federal government is going to help pay for reducing flood damages, the community will properly regulate development to ensure damages do not increase.

If the projects will be primarily structural, the state may request cost-sharing on preparing the plans. If the projects are going to be primarily non-structural, a citizens planning committee will be formed and the community will assign a staff person as liaison and floodplain planner. The result of this phase is a detailed plan that is reviewed at one or more public hearings, is adopted by the city council, and forms the basis for applications for state or federal financial assistance.

3. Implementation. At this phase, applications for needed outside funds are submitted. The community will be expected to administer the locally funded projects such as developing a flood warning system or amending its zoning ordinance. There is likely to be cost-sharing

on the major projects. It is recommended that the planning committee be used to monitor and evaluate progress.

POSSIBLE COURSES OF ACTION

As mentioned earlier, most of the Illinois River flood control projects have been completed. Overall basin planning has concluded that reservoirs are not feasible. Channel dredging is still being looked at in the Peoria Lake area, but if it is funded it will probably be for recreational purposes and may not affect flood levels.

Since it is not possible to control the river, the current approach is to look at the circumstances and options for each community. Many communities on the Illinois and its tributaries have had reconnaissance studies. Where structural projects are shown to be appropriate, the state or federal agency has proceeded on to steps 2 and 3. Two examples of this are Pontiac and Liverpool, both of which are having their detailed plans for levees finalized by the Corps of Engineers.

It has been determined that structural flood control projects will not be feasible in most of the remaining communities. Accordingly, we are proceeding with non-structural planning for the rest. Initially, this started with those towns who asked for help. The first town was Grafton. With the help of the regional planning commission and a citizens committee, a non-structural plan was prepared. Due to local concerns and needs, it focuses primarily on emergency services or flood fighting activities.

In 1984, the Division of Water Resources conducted the reconnaissance study for Kampsville. A citizens planning committee worked with State and village staff to develop a comprehensive flood hazard mitigation plan that includes raising the ferry road to ensure access during high water, floodproofing, elevating three buildings, acquiring 50 parcels of land, and converting the flood-prone target area into a community park and village asset. Funding for the work has come from the Division of Water Resources, the Federal Emergency Management Agency (FEMA), the Department of Commerce and Community Affairs, and the Division of Highways.

The next community was the Rome area of unincorporated Peoria County. With funding support from FEMA, the county conducted the phase I reconnaissance with in-house staff and a surveyor. The resulting recommendations could cost over \$5 million and would involve purchasing over 100 homes. Rather than wait to do a detailed plan for the hardest hit area, the County is preparing the detailed plan for only one of the potential target areas. Over \$2.7 million has been committed to purchase and clear that area with funds from the Division of Water Resources, the Federal Emergency Management Agency (FEMA), and the Department of Commerce and Community Affairs.

The Division developed a preliminary priority list of communities for assistance. Because non-structural projects require a high degree of local interest and potential for FEMA funding, flood insurance claims are being used as a measure of where attention is both needed and likely to bring results. During this fiscal year reconnaissance surveys are being conducted in Hardin, Calhoun County, Jersey County, Woodford County and Spring Bay. Assistance has been given to the City of Peoria to obtain FEMA funding to prepare a mitigation plan for Peoria and Peoria Heights.

Communities, both on or off the Illinois River, can obtain copies of the references and assistance in flood protection by contacting the Division of Water Resources at 310 South Michigan Avenue, Room 1606, Chicago, Illinois 60466.

WATER QUALITY

INTRODUCTION

The words "water quality" denote a standard of acceptable water conditions that is necessary to protect both the users and the streams health. The Illinois River System, utilized for every possible use at one point or another, has been the subject of analysis and monitoring for over a century. This paper will generally discuss water quality conditions, the monitoring efforts currently underway and trends for future monitoring activities.

BACKGROUND

Subtitle C of Title 35 of the State of Illinois Administrative Code provides three use designations for Illinois streams; each category has a specific set of water quality standards. General Use water quality standards protect water of the state of aquatic life, agricultural use, fishing, swimming and most industrial uses. The majority of Illinois streams come under this use designation. A somewhat stricter set of standards applies to public and food processing water supplies. These standards apply at any point at which water is withdrawn for use as a potable water supply or for food processing. A third set of standards applies to streams designated as Secondary Contact and Indigenous Aquatic Life Waters. This is the most limited designated use and applies only to certain streams in the Chicago area. These streams are designated for industrial and non-full-body contact recreational uses. Illinois' water quality standards for the three use designations are presented in Table 1.

General Use water quality standards for Illinois surface water resources were established for protection of aquatic life, primary (e.g., swimming) and secondary (e.g., boating) contact recreation, agricultural, and industrial uses. The purpose of Illinois' General Use Standards is considered synonymous with the "fishable/swimmable" goals of the Clean Water Act. Aquatic life use is generally the most sensitive instream use in terms of water quality requirements. Water quality suitable for protection of aquatic life, therefore, should assure other beneficial uses. Given this sensitivity of use, the IEPA's use assessment methodology focuses on aquatic life uses. The IEPA's Division of Water Pollution Control (DWPC) operates a surface water monitoring program to provide necessary environmental information to meet water quality management needs and objectives. The monitoring program includes collection and analysis of water chemistry, biological, habitat, sediment and fish flesh contaminant information through a number of individual monitoring projects. These projects include both fixed station networks, maintained from year to year, and projects conducted in different areas (nonfixed stations) depending on program needs. Fixed station networks are designed to provide background/ambient, current condition, and long-term trend information on water quality from a broad geographic area. Nonfixed station projects are designed to provide more intensive, site-specific water quality information for surveillance

Table 1

ILLINOIS WATER QUALITY STANDARDS

Parameter	Units	General Use	Public and Food Processing Water Supply	Secondary Contact and Indigenous Aquatic Life
pH	SU	6.5 minimum 9.0 maximum	6.5 minimum 9.0 maximum	6.0 minimum 9.0 maximum
Dissolved Oxygen	mg/l	5.0 minimum	5.0 minimum	4.0 minimum
Arsenic	ug/l	1000	50	1000
Barium	ug/l	5000	1000	5000
Boron	ug/l	1000	1000	--
Cadmium	ug/l	50	10	150
Chloride	mg/l	500	250	--
Chromium	ug/l	1050	50	1300
Copper	ug/l	20	20	1000
Cyanide	mg/l	0.025	0.025	0.10
Fluoride	mg/l	1.4	1.4	15.0
Iron (total)	ug/l	1000	1000	2000
Iron (dissolved)	ug/l	--	--	500
Lead	ug/l	100	50	100
Manganese	ug/l	1000	150	1000
Mercury	ug/l	0.5	0.5	0.5
Nickel	ug/l	1000	1000	1000
Phenols	ug/l	100	1.0	300
Selenium	ug/l	1000	10	1000
Silver	ug/l	5.0	5.0	100
Sulfate	mg/l	500	250	--
Total Dissolved Solids	mg/l	1000	500	1500
Zinc	ug/l	1000	1000	1000
Fecal Coliform	#/100 ml	200	200	1000
Ammonia Nitrogen	mg/l	1.5/15	1.5/15	2.5 April-Oct. 4.0 Nov.-March
Un-ionized Ammonia	mg/l	0.04	0.04	--
Nitrate Nitrogen	mg/l	--	10.0	--
Oil and Grease	mg/l	--	0.1	15.0

mg/l = milligrams per liter

ug/l = micrograms per liter

purposes or in response to known water quality problems. A listing and brief description of ongoing monitoring programs is found below:

Ambient Water Quality Monitoring Network (AWQMN) - A cooperative project with the U.S. Geological Survey to collect water quality information at 205 stream stations (Figure 1). A listing of stations in the Illinois River Basin, and years monitored, can be found in table 2. Percent violations of General Use Standards for 1978-85 are identified in Table 3.

CORE Subnetwork - A subnetwork of the AWQMN consisting of 38 stream stations and three Lake Michigan stations.

Pesticide Monitoring Subnetwork - A subnetwork of the AWQMN which screens for toxic organic substances.

Fish Contaminant Monitoring Program - A cooperative agreement between four State Agencies - Public Health, Conservation, Agriculture, and Environmental Protection. Fish tissue samples are taken from a network of fixed stream and lake stations throughout the State and tested for organochlorine compounds used to make pesticides and polychlorinated biphenyls (PCB). These toxic chemicals are readily taken up by the fish tested, and can subsequently be taken in by human consumption. Based on U.S. Food and Drug Administration consumptive level standards for humans, sport fish health advisories for Illinois waters are issued yearly, identifying safe levels of consumption for certain fish groups at locations around the State. In 1987, four lakes in the Illinois River Basin and stream reaches on the DesPlaines and Illinois River were included in the Advisory.

A general downward trend has been indicated by the sampling program. However, considering the limited sampling going on (78 fixed stream stations and 18 lake stations), and the influx of new chemicals being utilized, increase sampling of new chemicals would enhance this program's ability to effectively identify trends in contamination and transitions in chemical deposition in Illinois surface waters.

Facility-Related Stream Survey - The collection of macroinvertebrate, water chemistry, stream flow and habitat data upstream and incrementally downstream of a municipal or industrial wastewater treatment facility discharge.

Water Quality Modeling Surveys - Quantifies the effects of one or more discharges on water quality, and utilize predictive modeling to assess the effects of changes in discharge quality on a receiving stream.

Special Survey - Conducted as surveillance or follow-up monitoring in response to a suspected or known water quality problem. Special surveys are often conducted in support of enforcement proceedings.

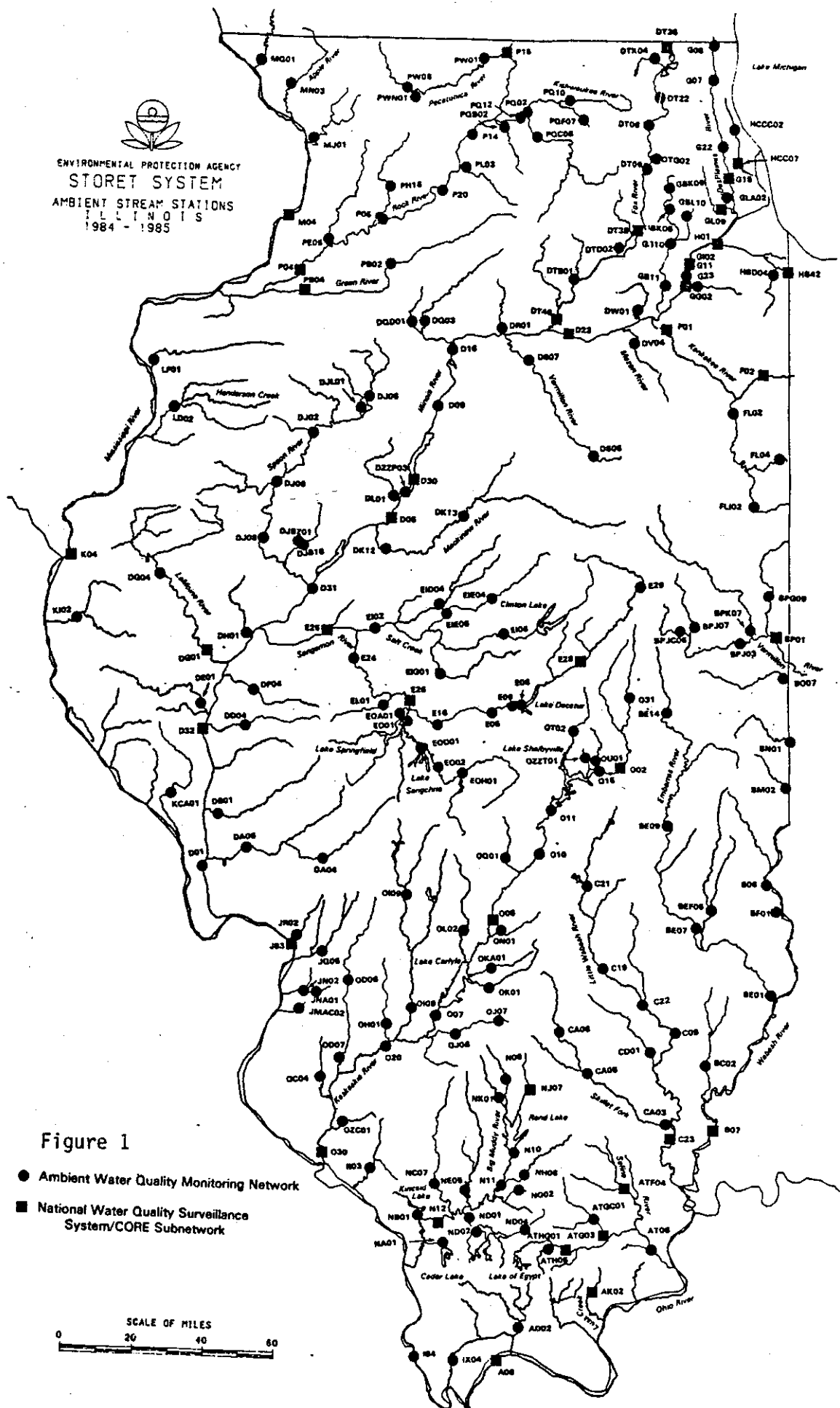


Table 2

AMBIENT WATER QUALITY MONITORING NETWORK (AWQMN)

IEPA Station Code	USGS Station Number	Reach File Number	Sampling Agency	Years of Record (to Present)	Stream Name	Drainage Area (sq. mi.)	County	Latitude Longitude	Legal Description	Verbal Description	Parameter Group Code
Illinois River Basin											
D 01	05587060	07130011003	IEPA	59-	Illinois River	28,690	Calhoun- Greene	39 09 37 90 36 55	T10SR2VS26NW	Rt. 100 Br. at Hardin	ASN02
D 05	05563800	07130003018	IEPA	59-	Illinois River	14,585	Peoria- Tazewell	40 34 23 89 39 17	T7NR7ES24SW	Rt. 9 Br. at Pekin	CORE1
D 09	05558995	07130001018	IEPA	59-61, 63-	Illinois River	12,953	Marshall	41 01 30 89 25 02	T12NR9ES13SE	Rt. 17 Br. at Lacon	ASN02
D 16	05556200	07130001025	IEPA	67-69, 72-	Illinois River	12,756	Putnam	41 15 26 89 20 45	T32NR2VS9NW	Rt. 26 Br. at Hennepin	ASN02
D 23	05543500	07120005001	IEPA ¹ - USGS	68-70, 75-	Illinois River	8,259	LaSalle	41 19 40 88 45 10	T33NR4ES13SW	Marshall's Down- stream from Madisco Bld.	CORE1 PEST1
D 30	05559900	07130001005	IEPA	70-72, 77-	Illinois River	13,900	Peoria	40 43 30 89 32 58	T9NR8ES26SE	Peoria PMS Intake	CORE1
D 31	05570520	07130003005	IEPA	78-	Illinois River	18,300	Mason	40 16 40 90 04 53	T21NR9VS11NE	Illinois Power Intake Near Havana	ASN02
D 32	05586100	07130011010	IEPA ¹ - USGS	75-	Illinois River	26,564	Scott	39 42 10 90 38 40	T15NR14VS34NW	Wabash RR Br.; 1/2 mi. E of Valley City	CORE1
DA 04	05586690	07130012003	IEPA	72-77, 79-	Macoupin Creek	304	Macoupin	39 12 05 89 58 41	T9NR8VS27NW	Macoupin Sta- Plainview Rd. Br.	ASN13
DA 06	05587000	07130012001	IEPA	78-	Macoupin Creek	868	Greene	39 14 03 90 23 40	T9NR12VS11SE	Rt. 267 Br., 3.5 mi. NW of Kane	ASN13 PEST1
DB 01	05586600	07130011005	IEPA	59,61-	Apple Cr.	404	Greene	39 22 11 90 32 46	T11NR13VS28NE	Co. Rd. Br., 6 mi. N of Eldred	ASN02
DB 04	05586040	07130011011	IEPA	78-	Mauvaise Tarre Cr.	146	Scott	39 43 53 90 24 26	T15NR12VS23SW	County Rd. Br., 1.5 mi. NE of Herritt	ASN02
DE 01	05585830	07130011026	IEPA	59,62-77, 78-	McKee Cr.	341	Pike	39 49 04 90 39 09	T3SR2VS8SE	Rt. 104 Br., at Chambersburg	ASN02
DF 04	05585275	07130011020	IEPA	78-	Indian Cr.	164	Cass	39 52 40 90 22 38	T17NR11VS31SE	County Rd. Br. SW of Arenzville	ASN02
DG 01	05585000	07130010003	IEPA	59,62, 64-	LaMoine R.	1,293	Brown- Schuyler	40 01 31 90 37 55	T1NR2VS33NE	US Rt. 24 Br. at Ripley	CORE1 PEST1
DG 04	05584500	07130010014	IEPA	75-	LaMoine R.	655	McDonough	40 19 45 90 53 55	T4NR4VS18SW	Rt. 61 Br. at Colmar	ASN22 PEST1
DH 01	05583915	07130003003	IEPA	59,71-77, 78-	Sugar Cr.	162	Schuyler	40 05 49 90 24 16	T1NR1ES17NW	Rt. 100 Br., 2 mi NE of Frederick	ASN13
DJ 02	05568915	07130005020	IEPA	59-62,64- 77,79-	Spoon R.	762	Knox	40 54 33 90 05 12	T11NR4ES30E	US 150 Br., 1 mi S 4 mi W of Williamfield	ASN13
DJ 06	05568775	07130005023	IEPA	72-77, 79-	Spoon R.	197	Stark	41 03 47 89 47 43	T13NR4ES34SE	Rt. 17 Br., 2 mi W of Wyoming	ASN13 PEST1
DJ 08	05570000	07130005005	IEPA	77-	Spoon R.	1,636	Fulton	40 29 24 90 20 26	T6MR1ES24NW	Rt. 95, 0.4 mi. NE of Seville	ASN13
DJ 09	05569500	07130005015	IEPA	79-	Spoon R.	1,062	Fulton	40 42 51 90 16 00	T8NR2ES3NE	Br. at North Edge of London Mills	ASN13
DJB 18	05570370	07130005004	IEPA	72-	Big Creek	41.2	Fulton	40 27 32 90 08 00	T6NR3ES3S	Co. Rd. Br. 2.0 mi. SW of Bryant	ASN13
DJBZ 01	05570380	Not Avail.	IEPA	75-	Slug Run	7.12	Fulton	40 28 24 90 08 37	T6MR3ES27NE	Private Rd., 2.5 mi NW of Bryant	ASN13
DJL 01	05568800	07130005026	IEPA	77-	Indian Cr.	62.7	Stark	41 01 06 89 50 07	T12NR6ES17SE	Co. Rd. Br., 3 mi. S; 3 mi. W of Wyoming	ASN13
DK 12	05568005	07130004001	IEPA	78-	Hackshaw River	1,092	Tazewell	40 26 51 89 41 28	T23NR5VS17NE	Co. Rd. Br., 4 mi. SSW of S. Pekin	ASN13
DK 13	05567510	07130004002	IEPA	78-	Hackshaw River	776	Tazewell	40 35 12 89 16 42	T25NR2VS36NE	4 mi. SE of Deer Creek at Co. Rd. Br.	ASN13 PEST1
DL 01	05563525	07130003020	IEPA	59-62,64- 77,79-	Kickapoo Creek	304	Peoria	40 39 18 89 39 19	T8NR7ES24SE	US 24 Br. N of Bartonville	ASN13
DQ 03	05556500	07130001033	IEPA	77-	Big Bureau Creek	196	Bureau	41 21 55 89 29 55	T16NR9ES18SE	Rt. 6 Br. Near Princeton	ASN13 PEST1
DQD 01	05557000	07130001034	IEPA	72-77, 79-	W Bureau Creek	86.7	Bureau	41 21 57 89 34 07	T16NR8ES21NE	US 6-34 Br. at E Edge of Wyanet	ASN13
DR 01	05555950	07130001031	IEPA	71-77, 78-	Little Ver- million R	125	LaSalle	41 20 00 89 04 51	T33NR1ES14NW	US 6 Br. in LaSalle	ASN07

Table 3

**PERCENT VIOLATIONS OF GENERAL USE WATER QUALITY STANDARDS AT AMBIENT
NETWORK STREAM STATIONS, 1978-86**

Basin	Year	DO	pH	Total		SO ₄	F	As	Ba	B	Cd	Cr	Cu	Fe	Pb	Mn	Ni	Ag	Zn	FC	TDS/EC	Hg
				Amm-N	Cl																	
Illinois	FY78	3	4	0	0	12	0	0	-	0	0	0	13	63	2	2	-	-	0	61	7	0
	FY79	1	1	1	0	7	0	0	-	0	0	0	9	63	1	9	-	-	0	67	3	3
	FY80	3	0	2	1	7	0	0	0	0	0	0	5	51	1	8	0	0	0	40	5	1
	FY81	2	0	0	0	7	0	0	0	0	0	0	6	51	0	5	0	4	0	54	4	1
	FY82	1	0	0	0	7	0	0	0	0	0	0	6	54	1	3	0	2	1	56	3	3
	FY83	2	1	0	0	4	0	0	0	0	0	0	6	58	3	4	0	3	1	59	4	1
	FY/WY84	3	0	0	0	5	2	0	0	0	0	0	3	62	2	2	0	2	2	51	6	1
	WY85	3	1	0	0	6	0	0	0	0	0	0	9	60	3	4	0	2	1	48	6	1

a FY = Fiscal Year, July 1 through June 30

b "-" = No data collected

c July 1, 1982 through September 30, 1984

d WY = USGS Water Year, October 1 through September 30

Intensive River Basin Surveys - Conducted for the overall characterization of stream resources in a major river basin or sub-basin.

It should be noted that these programs utilize, and are utilized by, several State agencies having extensive research and laboratory skills directed at Illinois water quality issues.

ACTIVITIES, PROGRAMS, AND STUDIES

A State agency with extensive water quality research and monitoring is the Department of Energy and Natural Resources -- State Water Survey (SWS) and Natural History Survey (NHS). Extensive research and data collection/analysis has been completed and new studies are ongoing. Some of the most noteworthy studies in the Illinois River include assessment of the impacts of ammonia discharges from the Peoria area on the Illinois River, D.O. studies evaluating the impacts of River barging, and a multitude of water quality related assessments.

The findings of these programs and studies are categorized and analyzed to identify existing and potential problem areas as well as high quality areas deserving of preservation. Trends in the Illinois River mainstem indicate improved water quality and habitat, but full use support is still hindered. It is often difficult to assign a specific cause of less than full use support to a given stream reach. Physical or chemical evidence may not be present during sampling periods, point discharges may be unknown or have intermittent toxic flows, and number and placement of sampling stations may be inadequate to detect what evidence does exist. In many cases there is probably more than one cause, further compounding the problem.

Trends in the Illinois River

The Illinois River has seen significant improvement in water quality. Although problems such as sedimentation, periodic low dissolved oxygen (DO) concentrations, and toxic contaminants still exist, all historical data point to marked improvement in water chemistry.

D.O. levels, indicative of a waters ability to assimilate organic waste, have improved greatly below Joliet (at I-55 Bridge) with most D.O. standard violations occurring in the Peoria and LaGrange Pools south of the bridge, and in the far upper reaches of the waterway. The improvement in D.O. can be credited to improved removal of carbonaceous and nitrogenous oxygen demanding wastes from municipal and industrial discharges.

These improvements can be credited to the State and local efforts in waste management as described in the issue paper on waste disposal. These programs, along with effective management of the National Pollution Discharge Elimination System (NPDES) permit

process, has significantly reduced waste contamination in the Illinois River. All wastewater sources containing deoxygenating material are required by state regulations to provide the equivalent of secondary treatment as a minimum prior to discharge. Discharges with little available dilution are required to provide additional treatment beyond this level including ammonia reduction in many instances. The larger dischargers along the Chicago River System and the Illinois River are specifically required to provide ammonia reduction as part of the treatment process. Sedimentation, however, persists in aggravating River conditions affecting D.O.

Recent studies completed by the State Water Survey at Peoria Lake (Demissie & Bhowmik, 1986) found that the heavy metal concentrations in sediment deposits have significantly decreased since the mid-1970's. Lead and Zinc especially showed marked improvements in Peoria Lake. The improvements have been attributed to upgrades in treatment of domestic and industrial wastes. Studies such as these are needed throughout the State, but especially on the major Rivers in Illinois. A clear assessment of erosion loading to streams and their basic makeup is needed.

The major cause of less than full use support in The Illinois River Basin is nonpoint pollution. Nonpoint sources are a major contributor of pollutant loadings to surface waters of the State. Activities which create major nonpoint pollution surces in Illinois include: agriculture, construction, coal mining, hydrologic modification, urban runoff, and recovery techniques associated with petroleum products.

As reported in the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) 1985 report title "America's Clean Water: The States' Nonpoint Source Assessment, 1985" agriculture is the single most significant contributor to the degradation of Illinois' surface water resource base. Nonpoint source contributions to streams and lakes are most prevalent during high flow conditions when the significance of point source discharges is reduced (flow ratio of discharge to receiving body of water). Hydrologic modification (i.e. channelization, straightening, deepening and obstruction clearing) is a major problem in agricultural areas with poor drainage, urban areas, flood plains, and coal mining areas.

Of the primary pollutants identified, sediment/turbidity was the most significant. Sediment/turbidity was the primary nonpoint source pollutant for 85 percent of the assessed rivers and 89 percent of the assessed lakes. The most significant nonpoint source category for rivers and lakes was agriculture. of the assessed rivers and lakes, 78 and 97 percent, respectively, were primarily affected by agricultural activities.

These results, when calculated from a more localized level, show clear regional trends. Highly urbanized areas, especially around the Northeastern part of the State clearly suffer from effects of intense population growth and development. Although newer development areas appear to be benefiting from heightened awareness towards construction erosion and soil stabilization, they still suffer from the effects of increased runoff from impervious surface areas and channelized stormwater transport streams.

Along the Illinois River, off-channel and backwater areas suffer from large scale agricultural practices and clearing of land for development.

Soil erosion and sedimentation contribute large amounts of nonpoint pollutants to Illinois water bodies. In an effort to deal with this, the State adopted a Soil Erosion and Sediment Control Program on January 1, 1983. A 17-year schedule ("T by 2000") targeted at reducing erosion levels to T, the soil loss value required to maintain soil productivity, was established. Discussion of this program and its implementation can be found in the issue paper on erosion control.

Since Illinois is faced with serious nonpoint source problems, emanating from several sources, it has been necessary to implement a variety of programs with technical support from State agencies. The continued efforts on the statewide level as well as focusing on priority watersheds will provide further knowledge on the nonpoint source problem as well as indicated effectiveness of ongoing control practices.

The findings of these assessments and programs on control of nonpoint pollution are that nonpoint pollution will continue to impair use of Illinois waterways unless further measures are taken, and that local management is the most effective means of control.

CONCLUSIONS

Based on these conclusions, and in review of ongoing programs, it appears that our Illinois River water quality problems have changed from our primary concerns with Dissolved Oxygen to newer monitoring and study of toxic fish contaminant levels and sediment characteristics as well as focusing on additional point discharges such as storm sewers. However, we should not ignore the continued findings of historical data as they are still the best trends indicators.

POSSIBLE COURSES OF ACTION

. Continue the extensive water quality programs now occurring while expanding assessments into the new generation chemicals.

. Local government must take a more active and aggressive role in nonpoint source pollution control through enactment of limited-use zoning, construction ordinances, development of stormwater management programs and creation of local revenue generation strategies for capital projects directed at nonpoint controls.

. The State (Department of Energy and Natural Resources and Illinois Environmental Protection Agency) should establish a state-wide sediment monitoring network to evaluate the magnitude of the problem and designate key problem areas in order to assist State and local officials in implementing control measures. Costs are as identified in the sedimentation issue paper.

. The Illinois Environmental Protection Agency will make an aggressive effort to implement the USEPA's program recommendations for management of stormwater discharge consistent with Section 405 of the Water Quality Act.

. Increased fish contaminant monitoring is needed for a more comprehensive evaluation of the problems and to refine the advisory criteria process.

. Best management practices (BMPs) for control of nonpoint source pollution should be implemented at all levels due to the benefits of sedimentation reduction, and their associated contaminants (i.e. Toxics, heavy metals, etc.).

. Since 70 to 90 percent of the pollutant loads conveyed by streams occur during storm events occurring less than 5 percent of the time in a year, it is necessary to monitor the mainstem of the Illinois River and its major tributaries during storm events. This will more clearly define critical areas, enabling the State to utilize limited resources more effectively.

. The State should investigate backwater lakes along the entire stretch of the river, and develop methods to render them more useful and biologically productive as in the past.

The following recent reports or reports in press by the State Water Survey, National History Survey, or the U. of I. Water Resources Center illustrate the rapidly advancing knowledge of Illinois River water quality.

1. 7-Day 10-Year Low Flows for Illinois Streams; ISWS reports expected in August/September, 1987
2. 7-Day 10-Year Low Flows of Streams in Northeastern Illinois; ISWS, 1983.
3. Contributions of surface runoff and flooding to agrichemical pollution in the Court Creek watershed; ISWS Report, in progress
4. The Impact of Greater Peoria Sanitary District Ammonia Discharges on Illinois River Water Quality -- ISWS Contract Report 373
5. Aeration Characteristics of Starved Rock Dam Tainter Gate Flow Controls -- ISWS Contract Report 423
6. Upper Illinois Waterway Water Quality -- a 1982 Study -- ISWS Contract Report; in press
7. Water Chemistry of the Illinois Waterway -- ISWS Circular 147
8. Effects of Wastewater Effluent Chlorination on Bacterial Densities in Receiving Water (Illinois River) -- ISWS Contract Report 376
9. Man's Effect on the Fish and Wildlife of the Illinois River -- INHS Biol. Notes No. 57. 24 pp.
10. The Development of Toxicity Indices for Assessing the Quality of the Illinois River -- University of Illinois Water Resources Center Research Report N. 96
11. Identification of the Water Quality Factors Which Prevent Fingernail Clams from Recolonizing the Illinois River, Phase II and III -- Univ. of Ill. Water Resources Center Report No. 157, 52 pp.
12. Rapid Assessment of Water Quality Using the Fingernail Clam, *Musculium Transversum* -- INHS, 1977
13. The Role of Contaminants in the Decline of the Illinois River: Implications for the Upper Mississippi in Contaminants in the Upper Mississippi River -- INHS, 1984
14. Distribution of Toxicity in the Sediments of the Illinois Waterway in Proceedings of the Conference on Urban Effects on Water Quality and Quantity -- INHS, 1984
15. A comparison of Illinois River Water Quality During Commercial and Noncommercial Navigation Periods -- Investigation in Progress.
16. An Assessment of the Impact of Combined Sewer Overflows at Peoria on the Waters of the Illinois Waterway -- ISWS Contract Report 330.

AQUATIC HABITAT, FORESTRY, WILDLIFE,

AND

NATURAL AREAS

INTRODUCTION

Little more than 150 years ago, the Illinois River basin was the haven of one of the most diverse, abundant, and valuable of aquatic fauna found anywhere in the United States. The wealth of natural resources within its basin; its fertile soils, timbered lands, and flowing waters teeming with a myriad of waterfowl, furbearers, fish and mussels, contributed immeasurably to the early development and welfare of the state and nation. Extensive bottomland water areas existed on the lower river below Hennepin in the form of river marshes, long narrow sloughs, ponds, and lakes.

Many changes have occurred within the Illinois River basin which have had a significant impact upon the river and its fish and wildlife population. During the 1850-1965 period, the number of people living in the basin increased from 500,000 to over 10,500,000. This rapid growth, especially of Chicago and other cities bordering the Illinois River, resulted in vast quantities of industrial wastes and human sewage being produced. Prior to 1900, Chicago dumped its untreated sewage into Lake Michigan, the Chicago River or the Illinois-Michigan Canal. Communities along the Illinois River poured their untreated sewage directly into the river.

By 1890, outbreaks of Cholera and typhoid posed a serious health threat to the citizens of Chicago because of their untreated sewage. To rectify the health crisis, the recently formed Chicago Sanitary District authorized a project which would carry away its health-threatening wastes and create a modern shipping canal between the Illinois River and Lake Michigan by diverting the flow of the Chicago River from Lake Michigan into the Illinois River by way of the Des Plaines River. By 1900, the Chicago Sanitary and Ship Canal was completed and put into operation. Initially the discharge of 3,000 to 9,000 cubic feet per second of water from Lake Michigan and Chicago, laden with untreated sewage, resulted in a brief period of increased fish production within the Illinois River basin. The increased flow raised the water level of the Illinois River and created additional fish habitat. The organic wastes borne by the diverted waters increased the nutrient levels of the water enhancing its productivity.

After 1908, however, fish production of the Illinois River began to decline sharply as its water could no longer assimilate the tremendous volume of Chicago sewage it received. The lethal zone of pollution crept down the river at an average rate of 16 miles per year. By 1911, septic conditions existed in the Chicago Sanitary and Ship Canal and the Illinois

River downstream to Marseilles. As increased quantities of sewage entered the Illinois River, the effect was devastating. Upper stretches of the river became void of oxygen and toxic.

Mayflies, which are indicators of clean water and are an important food of many species of fish, were no longer present in the upper two-thirds of the river after 1950. Fingernail clams, preferred by carp, channel catfish, and freshwater drum, virtually disappeared from the river above Beardstown after 1950. The loss of the river's important fish food organisms was undoubtedly one of the major factors contributing to the declining fish populations.

Since 1982, an improvement in water quality can be attributed largely to the passing of more stringent water pollution laws and their enforcement. Positive changes in the river's sport fish population have also been quite evident. Good walleye, sauger and white bass fishing is now present in the Starved Rock and Marseilles pools of the upper river, where 15 years ago only sickly, bullheads, goldfish and knothead carp with eroded fins and open sores on their bodies could be found. There are still periods of near oxygen depletion in several areas, however, and a legacy remains of polluted river bottom sediments.

At this point it must be stressed that it was not just the pollution of the Illinois River that lead to the degradation of the river. Primarily during the 1905-1920 period, some 200,000 acres of the river's rich bottomlands, sloughs and shallow lakes and ponds were ditched, drained and diked. Levees were erected to safely isolate 200,000 acres of flood plain from the river by 1930 -- 50% of the "overflowed land" between LaSalle and Grafton. These levied-off areas, which were vital to the river basin's high fish and wildlife productivity in terms of providing essential spawning, nursery and feeding areas, became productive cropland.

Another event that has altered the aquatic habitat and water quality of the Illinois River, influencing its production of fish, has been the development of navigation. Although a series of low level dams were built across the Illinois River before 1900, it was the construction of the high navigation dams during the 1930's that had the greater impact on the river. The pooling effect of the dams slowed its flow, which increased the rate of sedimentation because its capacity to carry its silt loads was altered. The heavy barge traffic has resulted in wave turbulences that have increased the turbidity of the water and caused erosive scouring of the river bottom and shoreline, directly affecting the ability of some fishes to feed and reproduce.

The practices of the agricultural community over the past 50 years have resulted in many deleterious impacts to the river and its numerous life forms. The destruction of timberlands for conversion to croplands, the cropping of steep sloped lands, and the intensified production of row crops has resulted in an alarming increase in the rate of soil erosion. The deposition of sediments in the river has resulted in its loss of flow capacity, the filling of adjacent bottomland lakes which are essential fish and wildlife production areas, and caused the smothering of valuable bottom-dwelling organisms and plants thus degrading quality habitat areas.

Remaining aquatic habitat suffers from heavy sedimentation estimated at 15.4 million tons of sediment per year deposited in water and on unleveled floodplain. The sum of these impacts on the lower three pools of the Illinois River has been a change in surface acreage of water from 33,936 acres in 1903 to 67,716 acres in 1978, but a reduction in average depth of off-channel water from 4 to 6 feet prior to 1900 to a dismal 2 feet in 1978. It is this continuing loss of depth and increased turbidity from sedimentation as evidenced over the past four decades that most threatens the present aquatic habitat and fisheries resources.

In addition, the increased production of row crops and the practice of monoculture have resulted in a greater use of herbicides, insecticides and fertilizers. Many of the agricultural chemicals used are persistent in nature and extremely toxic to fish and wildlife. When these chemicals are transported to aquatic environments, they are bio-accumulated by some fish, causing their flesh to be unsuitable for consumption.

Over the past 30 years, numerous agricultural chemical-caused fish kills have been documented within the Illinois River basin and its tributary streams. Fish kills on the Illinois River and its tributary streams have also been caused by numerous discharges from industrial and manufacturing operations, which discharge toxic heavy metals, inorganic and organic chemicals, and oxygen demanding organic waste such as wood pulp fibers, canning, dairy and food processing wastes.

In summary, the pollution of basin waters and sediments by human wastes and industrial and agricultural chemicals depleting oxygen levels and bottom vegetative food supplies, the modification of the river to accommodate navigation altering its flow and physical characteristics, urban and agricultural development removing vast acreages of forest and aquatic habitats, and the acceleration of the rates of sedimentation, have destroyed many highly productive bottomland areas of the Illinois River floodplain. The total sum of the many physical, chemical, and biological modifications of the basin waters and land has resulted in the virtual ruination of once valuable and vital natural resources. Concern for this loss prompted the Illinois River Conference of April, 1987.

BACKGROUND

The aquatic habitat resulting from natural processes aggravated by man's actions is far removed from the near pristine river existing in 1900. Oxygen depletion has become a problem in the backwater areas of the lower river as wind-generated waves resuspend materials from the now shallow lake bottoms, exerting an oxygen demand and removing dissolved oxygen from the water. The turbidity caused by sediment inflow coupled with wind and towboat generated sediment resuspension has eliminated most aquatic vegetation by reducing the water clarity needed for photo-synthesis and keeping bottom material too stirred ("soft") for plant roots to hold. Peoria Lake, the largest and deepest bottomland lake in the Illinois River valley, has lost 68% of its original volume due to sedimentations, has an average depth of only 2.6 feet, and has an estimated life expectancy of only 15 years. Other bottomland lakes will have a similar fate.

Water quality improvement is credited with restoring sport fisheries to the upper river where carp and goldfish and their hybrids comprised 77% of numbers in electrofishing samples collected 1959-1974. In 1984 carp, goldfish, and hybrids represented only 18% of the numbers in electrofishing samples, and channel catfish, white bass, largemouth bass, smallmouth bass, and walleye, which were not even found in the upper river in 1959 electrofishing, were 13% of the 1984 catch on that stretch. Riverwide, the few smallmouth bass collected in the 1959-1974 period were thought to have been introduced from tributary streams, and only one sauger was collected in over 290 hours of electrofishing, although it had been common prior to 1908.

Although fisheries monitoring will continue, it is apparent that consistent high quality of the overall fishery will not be possible on the Illinois River despite water quality improvements until deeper water areas are once again available to fish during low flow periods.

Today, our rivers and streams need the protection of forests more than ever as their purity is contaminated by substances and practices unknown in an earlier, simpler age. Forested lands adjacent to rivers can help reduce the effects of industrial wastes, thermal pollution, residues from commercial chemicals, and especially of siltation, while still also providing wildlife habitat. It is doubtful that the natural ecology of a river can exist and thrive unless the floodplain adjoining the stream is forested. When this forest is destroyed, more than trees are eliminated--the quality of water is quickly reduced, and the intricate community-relationship between plants and animals is endangered.

Historically, the Illinois River valley provided a diversity, quality and quantity of wildlife habitats of uncommon value. In 1673, Pere Marquette wrote, "We have seen nothing like this river that we enter, as regards its fertility of soil, its prairies and woods; its cattle, elk, deer, wildcats, bustards, swans, ducks, parroquets, and even beaver." In response to luxurious aquatic plantbeds, seasonally exposed mudflats, expanses of bottom-land forests, and the waters of the river and backwater lakes, wildlife flourished.

Today, most of this is gone--having succumbed to a series of events tied to settlement and progress. Aside from the loss of vast acreages of bottomland hardwood forest, little is more dramatic an example of a decaying resource than the disappearance and decline of wildlife in the river system. The once prolific number of waterfowl, furbearers, shorebirds, wading birds and other vertebrate fauna have been chronicled and--finally--grieved. Probably the most familiar and well documented of these has been the fall of waterfowl numbers, particularly the mallard, in the Illinois River valley. From the 1950-59 ten-year average of almost 1,200,000 peak mallard numbers on the river, the number dropped to slightly over 366,000 for the 1980-86 period. This represents a decline of over 70%. In 1984, an all time record low of 259,000 was noted. A shift of mallards to the Mississippi River has been observed, leading to the explanation that it is a function of a reduced habitat factor on the Illinois River. Additionally, the toxic river bottom sediments has reduced the food supply for diving ducks in the Illinois River.

The bays and backwaters of the Des Plaines River near Treats Island (commonly referred to as the Millsdale Waterfowl Hunting Area) have silted in severely over the past 20 years. The seven public waterfowl hunting blinds located at Millsdale used to provide the best waterfowl hunting on the Des Plaines River. Before extensive siltation, this shallow water area provided submergent and emergent aquatic vegetation in an ideal ratio to attract migratory waterfowl. Siltation and sedimentation has changed the dominant vegetation to cattails and lotus with very little open water. Access to the area is extremely limited for waterfowl and waterfowl hunters. Waterfowl use and therefore the quality of waterfowl hunting on this area has declined tremendously. A good recent example of this decline is shown by a total harvest of two wood ducks for all seven blinds on this area on the opening day of the 1986 central zone waterfowl hunting season.

Even though water diversion, drainage, pollution, and dams damaged the Illinois River's environmental system, it has been the insidious and relentless process of silt deposition and sediment re-suspension that have caused the most serious and long lasting problems. Any proposed solution to the river's ecological ailments that ignores or minimizes this factor cannot hope to achieve even a modicum of success. The decline of the river's biological integrity would persist without major funding and programs aimed at keeping excessive sediments from the river and its backwater lakes. This would include the wider application of farming practices with erosion control and water retention benefits (e.g., no-till, minimum till, conservation tillage), the establishment of filter strips and sediment traps, the acquisition of key parcels of land, the reforestation and stabilization of stream banks, and a major shift to cropping systems stressing hay and forage crops. Individually and collectively these would serve to minimize the silt load of the river and its tributaries, thereby reducing both the sediment rate and turbidity.

Natural areas are tracts of land and water that have escaped major disturbances by man and therefore have special value as examples of Illinois' original natural ecosystems and habitats. They often support rare or unusual natural plant communities and animals. In the Illinois River basin these areas include streams, wetlands, bottomlands and uplands. Vegetation ranges from open water (submerged) to forest, prairie, marsh, bog and fen. These natural areas need to be protected from destruction due to conversion to other uses.

More frequent and unnatural flooding, siltation problems, pollution problems, and exotic weeds also threaten Illinois River basin natural areas. Unnaturally high and severe floods along the Illinois River have a negative impact on some natural areas. At Spring Bay Fen, on the east shore of Peoria Lake, flooding is killing rare plants in an area that was rarely flooded in the past, but which floods almost annually now. At other natural areas, emergent aquatic plants have been killed by summer floods. A coordinated program of slowing runoff through land treatment and regulating Lake Michigan diversion waters can help alleviate this problem.

Plants introduced into an area can also threaten natural areas. Purple loosestrife is an aggressive exotic plant invader of wetlands that degrades natural areas and other wildlife habitats. It is a serious pest in the upper Fox River basin and is rapidly spreading throughout the

Illinois River basin. Recent legislation prohibits sale and planting of this pest in Illinois, but control of existing populations is hindered by lack of funds for aerial surveys to locate and monitor populations.

ACTIVITIES, PROGRAMS, AND STUDIES

Aquatic Habitat

An ongoing Department of Conservation fisheries monitoring effort initiated in 1975 provides data on changes in populations at 21 sites on the Illinois River from river mile 8.8 to mile 271.5. Fish samples are collected at these sites with electro-fishing gear once each summer for comparison to previous samples. These samples have illustrated that the loss of deeper water habitat can have a dramatic impact on fish populations in low river flow years when fish are subjected to winterkill as in the winter of 1976-77. Catchable-sized sport fish in samples the following summer (1977) were only 30% the numbers found in 1975 samples, but higher river flows in the early 1980's encouraged recovery to 97% by 1984. Smallmouth bass, walleye, and sauger favor the type of habitat found on the upper river where water quality has improved and backwaters have always been few. On the lower stretch, where the numbers of largemouth bass, crappie, sunfish and bullheads are especially dependent on maintenance of the backwater areas favored by these species, monitoring indicates dramatic fluctuations in numbers can occur from year to year dependent on river flow. These fluctuations would not be near as evident if there was sufficient depth in river backwaters to maintain fish even in low flow years.

A Federal Aid in Sport Fish Restoration Act, Dingell-Johnson (DJ) Program, study is being conducted on Lake Peoria by the Illinois State Water Survey. The effort was initiated in July, 1986, and consists of experimental installation of a breakwater constructed of old automobile tires and planting of aquatic vegetation behind this protective barrier. It is hoped that the relatively inexpensive breakwater will reduce wind and towboat generated sediment resuspension and movement, so that the aquatic vegetation planted behind the barrier will become well rooted and grow to start establishment of beds of aquatic vegetation. The aquatic vegetation could further block sediment movement and reduce turbidity, improving fisheries habitat by providing cleaner water, shelter for fish and a high production area for invertebrates fed upon by fish. Baseline fisheries data has been collected in 1986 and 1987, the breakwater put in place in early summer 1987, and plantings of broadleaf arrowhead in 1987 have survived and exhibit good growth. Year one of the study has been completed with two more years left during which removal of the breakwater overwinter (to protect it from ice damage), plantings of different aquatic plant species, expansion of the original plantings, and impacts on local fisheries will be studied. Study completion will be June 30, 1989.

Another DJ federal aid project is an Illinois Natural History Survey study of behavior and movement of adult channel catfish in the Illinois River before, during, and after a 50-day shutdown of commercial navigation due to Peoria and LaGrange lock closures in July, August, and September,

1987. The radiotelemetry study will provide insight into use of the deeper water of the navigation channel and how that use changes with resumption of commercial tow traffic. Since virtually all deeper water areas outside of the navigation channel have been lost to sedimentation, this study could demonstrate if channel catfish have a marked preference for deep water, and, if so, how that preference is impacted by disturbance from tow traffic. More than two dozen catfish have been implanted with radiotransmitters and much movement has been recorded. The Department of Conservation Fisheries Streams Program will also use the navigation cessation period as an opportunity to gather information on any main channel preference by other fish species using a variety of netting gear and electrofishing to collect samples from the deeper water of the main channel during absence of disturbance from tow traffic. These studies will be completed in 1988, with analysis of results and final reports completed in 1989.

DJ funding is being proposed for a creel survey of twenty miles of the upper river to gather information on the extent of the sauger and walleye fishery that has developed below Starved Rock dam in response to improved water quality. The proposed study would relate angler harvest to Department of Conservation monitoring data and responses from angler diaries, to provide insight into effectiveness of the monitoring in tracking development of the sauger-walleye fishery. If approved and funded for 1988, initiation of the study would be completed in 1990.

DJ funding is also being proposed for a study of fish movement and use of deeper water off-channel areas overwinter and an assessment of how critical these areas are to overwinter survival. If approved and funded it would start the fall of 1987 and continue until fall 1990.

The Department of Conservation chairs the Illinois River on-site inspection team of US Army Corps of Engineers, Illinois Division of Water Resources, and Illinois Environmental Protection personnel. The team seeks to find disposal areas for material from navigation channel maintenance dredging that will be least damaging to the environment. Protection of aquatic habitat from filling or pollution from the dredged material is one of the top priorities of this ongoing effort.

Forestry

Technical assistance to public and private forest landowners is the major forestry program of the Department of Conservation. Preparation of forest management plans and associated field service forestry activities such as wildfire prevention and suppression, insect and disease control, tree planting instruction, designation of surplus trees to be removed in forest improvement practices, forest product utilization and marketing, and on the ground assistance in helping landowners conduct timber sales, have been the traditional means of maintaining, enhancing, and retaining our remaining 4.26 million acres of Illinois forestland. A growing urban forestry assistance program now compliments the rural forestry programs.

The Department of Conservation has and will continue to participate in PL566 funded watershed programs as well as state and locally financed watershed land treatment programs.

There are several cost-share programs now offered which provide financial incentives for forestation and cultural practices to improve and enhance existing forest. The 6 mentioned programs are targeted to control erosion and reduce non-point sources of pollution.

- . FORESTRY DEVELOPMENT ACT (FDA) - A State cost-share program administered by the Department with funds from the Forestry Development Fund. Cost-share is provided for tree planting, site preparation, vegetation control, firebreaks, fencing and timber stand improvement. This program can be utilized by private landowners owning five or more acres in conjunction with the three Federal cost share programs listed below. Statewide, there are 1,156 forest management plans in effect under the act. Acreage amounts to approximately 56,700 acres. Figures for plans and acres within the Illinois River basin are not available, however, an estimate would be 400 plans covering 16,000 acres within the basin.
- . AGRICULTURAL CONSERVATION PROGRAM (ACP) - A Federal cost-share program administered by the Agricultural Stabilization and Conservation Service (ASCS), with technical assistance provided by the Department of Conservation, includes cost sharing for tree planting, site preparation, vegetative control and timber stand improvement. Funding for this program comes from the Federal General Revenue Fund.
- . FORESTRY INCENTIVE PROGRAM (FIP) - A Federal cost-share program administered by the ASCS, with technical assistance provided by the Department of Conservation, which includes cost sharing for tree planting, site preparation, vegetation control and timber stand improvement. Non-industrial landowners with a Department of Conservation approved Forestry Management Plan and a minimum of ten acres may qualify. Funding for this program comes from the Federal General Revenue Fund.
- . CONSERVATION RESERVE PROGRAM (CRP) - A Federal cost-share program administered by the ASCS, with technical assistance provided by the Department of Conservation, which includes cost sharing for tree planting, site preparation, grass, legume plantings, prairie establishment or wildlife plantings. The program is targeted at revegetation of highly erodible lands which are presently in annual agricultural crops. An annual rental payment is also provided for a 10 year period. Funding for this program comes from the Federal General Revenue Fund. Of acres in the Conservation Reserve Program, there are over 4,500 acres statewide that have been committed for tree planting. Exact figures are not available for the Illinois River basin. It is estimated that there will be about 1,200 acres either already planted or designated for planting by the spring of 1988 within the basin.
- . FORESTRY TECHNICAL ASSISTANCE - This program provides the necessary information, guidelines, assistance and training in implementing proper forest management, reforestation, harvesting and marketing techniques, urban planning, and forest protection which includes fire, insect, disease and environmental assessment. Detailed

management plans and guidelines are provided with erosion control and reduction of non-point sources of pollution as a primary concern. Forestry technical assistance is funded from the General Revenue Fund on an annual basis.

- . NURSERY PLANT MATERIAL PRODUCTION - This program provides trees, shrubs and prairie plant material for reforestation, afforestation and restoration projects on highly erodible lands. Current annual production is about 3 million seedlings per year. Funding is provided from the General Revenue Fund and the Fish and Wildlife Fund.

Wildlife

The Department of Conservation owns and manages a number of sites along the Illinois River where management for waterfowl is currently part of routine operating procedures. These include Anderson Lake, Calhoun Point, Des Plaines, Donnelley, Fuller Lake-Helmbold, the Glades, Godar-Diamond, Lake DePue, Marshall County, Pekin Lake, Piasa Landing, Powerton Lake, Red's Landing, Rice Lake/Big Lake, Sanganois, Sparland, Stump Lake and Woodford County. Many of these sites have some water level management capabilities and programs. The others possess refuges, provide feeding areas, or allow duck hunting. Projects aimed at upgrading, expanding, protecting, or increasing the life span of such facilities are currently on file. Completion of these already identified project needs would create a significant number of acres of fairly long-lived, manageable backwater areas reminiscent of those of a hundred years ago.

With financial support from the Department of Conservation and other funding sources, the Natural History Survey has been aerially monitoring waterfowl populations in the Illinois River valley since 1948. These censuses provide information on the distribution and abundance of various waterfowl species during fall and spring migration with the changing aquatic habitat in the river floodplain.

There are four Department of Conservation projects planned in the Illinois River basin: (1) Banner Marsh levee renovation to reduce flooding and sedimentation, (2) Godar Diamond Island to remove brush reclaiming open water areas from willow, silver maple, and cottonwood invasion, (3) Rip Rap Landing repair of levee and ditch to provide water to wildlife feeding areas and to improve public access, and (4) Stump Lake levee improvements to reduce flooding. The combined cost of these projects is expected to be over \$700,000.

In addition there have been various projects proposed within the Illinois River basin. No funding commitments have yet been made for these projects. The largest project proposed is for Rice Lake. This project would include the re-establishment of a washed out levee and other site improvements to protect Big Lake from flooding seven out of ten years and also reducing sedimentation of the lake. This work would benefit eagles, cormorants, waterfowl, and other wildlife at an estimated cost of \$3.4 million.

Other proposed, but to date unfunded projects, include Fowler Lake levee construction, Crull Refuge levee expansion, Sanganois raising of levee and construction of additional levee, Millsdale Waterfowl Area

dredging to restore aquatic plant beds, Pekin Lake levee rehabilitation, Swan Lake levee construction, and Knapp Island raising of levee. These projects have been proposed to expand and enhance existing bird and waterfowl feeding areas. The estimated total cost of all these projects, excluding Rice Lake, is \$4.6 million.

Natural Areas

The Department of Conservation's principal program to identify natural areas is the Illinois Natural Areas Inventory. It is one of the most complete inventories of terrestrial natural areas in the country. Its inventory of stream resources is less complete. Data is available as county reports and computer assisted searches are possible.

The Department, in cooperation with the Illinois Nature Preserves Commission, has a major preservation program in place to protect natural areas. This program includes purchase by the Department or private/local preservation interests, dedication as Illinois Nature Preserves to assure long term preservation, agreements (Natural Heritage Landmarks) with private landowners to protect areas as Natural Heritage Landmarks, and protection from regulated development projects. Considerable time and money is spent on management of natural areas, many of which are developed for public use.

Examples of major natural areas along the Illinois River and its major tributaries include Allerton Park and Carpenter Park Nature Preserve on the Sangamon River, Spring Bay Fen, Miller-Anderson Woods and Starved Rock nature preserves on the Illinois River, Momence Wetlands and Kankakee River Nature Preserve on the Kankakee River, Ryerson Woods and Lockport Prairie nature preserves on the Des Plaines River and a host of wetlands including Volo Bog in the upper Fox River basin. Portions of the Mackinaw and Kankakee rivers themselves are designated natural areas.

The primary protection program is acquisition and dedication as a nature preserve. This program is dependent on "Build Illinois" funds through the Natural Areas Acquisition Program. In 1986 and 1987 seven natural areas within the Illinois River basin were purchased through the Natural Areas Acquisition Program. These sites total over 900 acres. The seven sites are Wolf Road Prairie, Calamus Lake, Vesley-Simpson Prairie (a 150-acre sand prairie), Mananzas Prairie, Meredosia Hill Prairie, 480 acres called Hooper Branch Savanna, and Shick Shack Sand Pond. An additional twelve acquisitions within the basin are planned for 1988 to 1990. To date the Natural Areas Acquisition Program has been funded \$7 million through Build Illinois.

Executive Order #7 (1985) is also an important tool for the protection of natural areas from a variety of development projects. Corps of Engineers permits are also useful. These programs should be maintained as important tools for protecting the public's interest.

In 1985 and 1986, the Department of Conservation surveyed a small portion of the Fox and Des Plaines River basins for purple loosestrife. In 1987, however, insufficient funding prohibited continuation of the survey.

POSSIBLE COURSES OF ACTION

Aquatic Habitat

Actions to improve degrading aquatic habitat include items listed below.

1. Continue fisheries monitoring to document impacts of changes in aquatic habitat.
2. Evaluate the success of the tire breakwater experiment at Peoria Lake for possible implementation in other areas to reduce bottom resuspension and encourage re-establishment of aquatic vegetation.
3. Support studies of means to reduce stream bank erosion (such as Court Creek studies) thus reducing sediment input from that source.
4. Initiate studies of the bottom contaminants in the upper Illinois River to ascertain which items are toxic and limiting to needed food resources to improve the fisheries. Once these items are identified, seek methods of detoxifying or neutralizing the sediments.
5. Continue ongoing studies and support proposed studies assessing the relative importance of deep water areas to survival of the fisheries populations. Critical data is needed to show importance of other activities aimed at sediment reductions, pollution abatement, and aquatic vegetation re-establishment.
6. Initiate or support studies to develop inexpensive effective means of re-creating deep water areas within backwater areas and of acquiring and restoring selected drainage and levee districts of levee-protected floodplain or lake areas.

Forestry

1. Expand the technical assistance program to advise owners of grazed forest land of ways to protect the forest and better forest management techniques. Identify owners of highly erodible cropland and advise them of possible land use changes and tree plantings and encourage establishment of greenways along streams to reduce soil erosion.
2. Provide funding for a strengthened urban forestry program, use this program as a way to convince municipalities to retain forest land and to establish greenways.
3. Recognize the significant long-term role played by forests in providing high quality water by making taxes on this land use minimal and based on that lands' income generating potential. Provide incentive to landowners in regard to taxation of these lands, thereby enabling landowners to continue forest land use rather than change to other less

environmentally valuable land uses. Maintain provisions of the Farmland Assessment Act to provide lower taxes on lands classified as forest.

4. Also needed is a 4 to 5 fold increase in nursery seedling production. Presently production at the State nurseries is about 3 million seedlings per year. A capital and operational budget increase for nurseries and contractual growing additional seedlings would require an additional \$3.5 million for the first year and \$1.5 million per year thereafter.

Wildlife

1. Provide technical and economic assistance to the Department of Conservation to assure completion of identified projects which have some degree of funding and support base. These projects would include Banner Marsh levee renovation, Godar Diamond Island brush removal, Rip Rap Landing levee repair, and Stump Lake levee improvements. Additionally, funding should be pursued for the proposed wildlife projects discussed in this paper.

2. Funding should be made available on a cost share, grant, or loan basis to private duck clubs and other such organizations for expansion and improvements of water control structures and equipment. This program would improve and expand their ability to create seasonal off-river lakes to benefit resident and migrant wildlife, primarily ducks, geese, shorebirds and wading birds.

3. The Wildlife Habitat Acquisition Program should be funded at originally planned levels.

4. Continue financial support for the aerial censuses of waterfowl populations during fall and spring migration in the Illinois River valley.

Natural Areas

1. Restore Build Illinois funding for the Natural Areas Acquisition Program to originally planned levels in order to prevent natural areas from being lost to land clearing and housing development.

2. Additional aerial survey work is needed to identify and monitor purple loosestrife populations, a serious threat to wetlands in the Illinois River basin. Approximately \$8,000 would be needed to contract an aerial survey for the northern half of the state.

General Recommendations

1. Some of the above action suggestions require some buildup of personnel to promote these actions, and to plan and coordinate these programs. Local, regional and State priorities should be defined and funding secured for these priority projects. Federal and State cost share programs should be used as much as possible to make dollars go further. Additionally, local and State programs need to be coordinated to compliment and enhance existing programs and defined priorities.

2. Strengthen local zoning requirements to reduce land use changes in floodplains of the basin. Avoid filling of flood plains and wetlands. Require less intensive land uses on flood plains.

3. Continue the partnership approach of government and private interest groups, such as with the Partners in Conservation effort to promote cooperation between private interests and government toward mutually beneficial fish and wildlife habitat improvements.

4. Aggressively work to arrest the degradation of natural resources caused by erosion and sedimentation. Specific recommendations are included in other sections of this report. Demonstration projects and research should concentrate on protecting and enhancing the condition of natural resources at existing sites thus protecting investments already made.

5. Establish priorities for acquisition programs and determine where the quality natural resources are by completing resource inventories and initiating planning based on the resulting data. Some inventories already begun are: Illinois Fish and Wildlife Information System identifying locations of species, Illinois Streams Information System identifying the resources of stream corridors, and the Illinois Wetlands Inventory identifying the locations of wetlands. Once completed, the data from these inventories can then be used to identify quality natural resources and set priorities for acquisition.

6. Initiate a Statewide Greenways Program to focus resource protection on Illinois' major rivers, such as the Illinois River and its larger tributaries.

LAKE MICHIGAN DIVERSION

INTRODUCTION

Water levels on the Great Lakes have been abnormally high for over two years. By the end of January 1987, Lakes Michigan/Huron had set new record monthly highs for 16 consecutive months. Flooding on Chicago's famed Lake Shore Drive has become an all too frequent occurrence. Throughout the Great Lakes, widespread flooding and shoreline erosion, destruction of lakefront homes and coastal property and loss of valuable recreational facilities has again renewed interest in taking whatever measures are available to better control high water levels. On August 1, 1986, the two federal governments asked the International Joint Commission, a bi-national commission formed to resolve disputes over boundary waters between the U.S. and Canada, to undertake a one year study of all existing control measures that could be implemented to provide some relief from high water levels. This includes increasing Illinois' diversion of Lake Michigan water.

Increasing Illinois' diversion of Lake Michigan water is a subject that generates strong opinions by both proponents and opponents. Its role in lake level management is often misunderstood. The purpose of this paper is to briefly review the history of Illinois' diversion, the legal status of the diversion, the primary uses of our Lake Michigan diversion and finally, a discussion of the issues surrounding the potential for increasing the diversion.

BACKGROUND

Illinois' diversion of Lake Michigan water actually began back when the Illinois and Michigan Canal was opened to traffic in 1848. At that time, annual diversion from Lake Michigan was in the order of 100 cubic feet per second (cfs). In 1854 and 1885, major storms caused massive amounts of untreated sewage to be carried far out into Lake Michigan. This contaminated water found its way into the City of Chicago's water intakes, and caused an outbreak of two waterborne diseases, typhoid and cholera. In the 1885 epidemic, 90,000 people were killed. To correct this dangerous situation, the Sanitary District of Chicago (predecessor of the Metropolitan Sanitary District of Greater Chicago) was created and immediately began a major construction project to change the direction of flow of the Chicago and Calumet Rivers so that water from Lake Michigan and sewage from Chicago flowed into the Illinois River, which drains into the Mississippi River (Figure 1). Flow through the Sanitary and Ship Canal began in 1900 under permits issued by the Secretary of War. The North Shore Channel was completed in 1910, and the last leg, the

Calumet-Sag Channel, was completed in 1922. The design capacity of the system was 10,000 cfs.

A 1910 Corps of Engineers' permit limited diversion through all channels to a combined total of 4,167 cfs. Table 1 is a listing of the monthly and annual mean diversions from Lake Michigan from 1900 through 1970. It is interesting to note that from 1900 through the late 1920s, diversion steadily increased, reaching a maximum (10,000 cfs) in the late 1920s. Diversion then began decreasing (in response to a 1930 U.S. Supreme Court Decree) and took an abrupt decrease after 1938 and has remained at approximately 3,200 cfs ever since. During a 2-1/2 month period in 1956/1957, an increased diversion to 8,500 cfs was authorized by the Supreme Court to be used to alleviate extremely low flow conditions on the Illinois and Mississippi waterway systems due to a prolonged drought.

There is no question that the diversion project played an extremely important role in the continued development of the Chicago metropolitan area. Not only did it help to ensure a safe, dependable source of water supply for the area, but it also created a greatly improved transportation link between the Illinois/Mississippi River system and the Great Lakes.

Legal Status

Illinois' diversion of Lake Michigan water has generated sufficient controversy among the Great Lakes states and lower Mississippi River states such that the issue has come before the U.S. Supreme Court on several occasions. The possible health threat to St. Louis when the Sanitary and Ship Canal was first opened in 1900 prompted the first of many U.S. Supreme Court decisions in 1906. Concern over the possible adverse impact on water levels of the Great Lakes from the increasing diversion led the states of Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin to sue Illinois to stop its diversion. Having been convinced earlier that the diversion did not degrade water quality in the Mississippi River, the states of Missouri, Kentucky, Tennessee, Louisiana, Arkansas and Mississippi joined Illinois' defense. In a 1930 Supreme Court decree, Illinois was directed to reduce its diversion to no more than 6,500 cfs, by 1935 to 5,000 cfs and by 1938 to only 1,500 cfs. At that time, water withdrawn for domestic purposes was not subject to any limitation, even though most of it was also diverted. The reduction in diversion into the Sanitary and Ship Canal system coincided with ordered completion of sewage treatment facilities.

In 1958, a suit was again brought before the U.S. Supreme Court by the Great Lakes states asking that Illinois be directed to return its treated sewage effluent to the lake. After an extended period of collecting testimony by the Court's appointed Special Master, the Court approved a new decree in 1967 that limited Illinois' diversion to 3,200 cfs, including domestic pumpage. A 5-year running average was to be used to determine compliance with the 3,200 cfs limitation. In 1980, the Court amended the 1967 Decree to extend the averaging period from 5 to 40 years to allow Illinois to use its diversion more

efficiently.

The 1967 U.S. Supreme Court Decree, as amended in 1980, allows Illinois to determine how the diversion should be apportioned among various competing interests. The General Assembly has directed the Department of Transportation to develop a continuing program for the apportionment of water to be diverted from Lake Michigan among regional organizations, municipalities, etc. for domestic purposes or for direct diversion into the Sanitary and Ship Canal.

Illinois' Diversion Today

Illinois' diversion can be broken down into 3 primary categories: domestic water supply, direct diversion and stormwater runoff.

Domestic water supply is by far the largest category, and currently accounts for about 52 percent of our allowable 3,200 cfs diversion. Withdrawals occur along the Illinois shoreline at 15 separate water treatment plants. Chicago's two water treatment plants alone average 1,500 cfs, serving Chicago and its suburban customers. Currently, about 5 million people in northeastern Illinois use Lake Michigan water. By the year 2000, this number will grow by an additional 1.7 million, due to regional growth in the area and the expansion of the Lake Michigan service area westward in DuPage and northwestern Cook Counties. This growth in domestic use of Lake Michigan water can be attributed to the 1980 amended Decree which enables a more efficient allocation of our diversion, to a reduction in the direct diversion of Lake Michigan water into the Chicago Sanitary and Ship Canal system as a result of the improvement in wastewater and stormwater treatment and to the water conservation requirements that must be adopted by all users of Lake Michigan water.

Direct diversion of Lake Michigan water into the Sanitary and Ship Canal system occurs for two primary reasons: 1) to provide for safe navigation, and 2) to improve water quality in the canal system upstream of Lockport. Direct diversion occurs at three separate locations: at the mouth of the North Shore Channel at Wilmette, at the mouth of the Chicago River, and at the mouth of the Calumet River. There are navigation locks and controlling works on both the Chicago River and Calumet River; at Wilmette, there is only a controlling structure to allow lake water to enter the North Shore Channel.

Direct diversion for navigation purposes currently requires approximately 215 cfs, and includes water used in lockages, leakages, and to restore adequate depths in the canal after the threat of a storm event has passed. This component of diversion has been decreased in recent years due to the improvements in management of the canal system made possible by the implementation of the Metropolitan Sanitary District of Greater Chicago's Tunnel and Reservoir Plan.

The diversion of lake water into the canal system for water quality enhancement is called discretionary diversion, and has been

set by state law at 320 cfs through the year 2000. After 2000, it will be reduced to 101 cfs. This component of diversion is used during the warm weather months only to improve water quality in the canal when most needed. Discretionary diversion occurs at all 3 locations.

The last category of Illinois' diversion is stormwater runoff from the 673 square mile watershed that was diverted by the reversal of the Chicago and Calumet Rivers. Under the provisions of the Supreme Court decree, this component of flow must be included in Illinois' allowable 3,200 cfs diversion. Although it is impossible to accurately measure this flow component, it probably is in the range of 680-700 cfs. This flow component is expected to increase as the Chicago metropolitan area becomes more developed, since stormwater runoff is higher from urbanized areas versus less developed areas.

Most of the dry weather flow at Lockport consists of wastewater treatment plant effluent from 3 large plants operated by the Metropolitan Sanitary District. The remainder consists of natural flows of the Chicago River, Little Calumet River and Grand Calumet River and direct diversion for lockages and leakages and, depending on the time of year, discretionary diversion. During significant storm events, stormwater runoff from the diverted watershed is discharged to the Chicago Sanitary and Ship Canal system through combined sewer overflows and storm outfalls. Discharges in excess of 20,000 cfs at Lockport can occur. On rare occasions, backflows to Lake Michigan are allowed to prevent serious flooding in the Chicago metropolitan area.

ACTIVITIES, PROGRAMS AND STUDIES

Illinois' diversion of Lake Michigan water has been controversial ever since its inception. More recently, discussions about an increase in Illinois diversion has similarly stirred strong feelings on both sides of the issue. The complexity of the Illinois River ecosystem, the influence of both man-made and natural factors on its flow, productivity and quality make quantitative assessment of the impacts of a particular plan for an increased Lake Michigan diversion very difficult.

In 1976, Congress authorized the Corps of Engineers to conduct a five-year demonstration and study program of increasing Illinois' Lake Michigan diversion from 3,200 cfs up to 10,000 cfs. Although an actual increase in diversion was never implemented, the Corps did complete an information report to the Congress in April 1981 which summarized their study findings. During this evaluation, engineers and scientists from the Illinois State Water Survey and Natural History Survey evaluated the physical, chemical, and biological impacts of the proposed diversion. This included research on the effects of an increased diversion on sediment transport and deposition, bank erosion, water quality, aquatic life, wildlife, flooding and agricultural impacts.

While a detailed review of that report is beyond the scope of

this paper, of particular interest is their finding that since one of the constraints was that increased diversion would not be allowed during periods of heavy rainfall (to avoid the possibility of any increased risk of flooding), an annual increased diversion of up to 10,000 cfs could not be achieved. During a dry year, diversion could be increased to approximately 8,700 cfs on an annual average basis while during a wet year diversion could be increased to only about 5,000 cfs.

The 1981 Corps report found that an increased diversion was not economically justified, considering the impacts on both the Illinois waterway and the Great Lakes system. Concerning environmental impacts on the Illinois waterway, generally they were able to describe both beneficial and adverse effects expected to occur from an increased diversion.

The original operating plan sought to increase diversion to the maximum extent possible (10,000 cfs), subject only to the constraint that when river stages were predicted to approach bankfull conditions that increased diversions would be temporarily discontinued. The Corps acknowledged that their operating plan could be revised to be more sensitive to the various interests along the Illinois waterway. For example, during low flow periods, an increased diversion may be beneficial to most of the various waterway interests. Developing an operating plan keyed to the concerns and needs of the various user groups on the waterway, paying particular attention to those areas subject to flooding, it should be possible to avoid adverse impacts. The Corps is updating their 1981 report and is developing a new operating plan with the goal of providing net benefits to the Illinois waterway system.

The subject of water regulation on the Great Lakes has received much attention over the years on both sides of the border and has been the subject of several long studies by the International Joint Commission. In 1983, the Commission concluded that modification of the existing diversions into and out of the Great Lakes system would not be economically beneficial to achieve better water level regulation on the Great Lakes. However, the record high water levels from 1985 through 1987 caused the federal governments of the United States and Canada to forward a study reference to the International Joint Commission asking them to prepare a report within one year of measures that could be implemented within one year to achieve a lowering of water levels throughout the Great Lakes system. The study reference also asks that they initiate a longer term study to evaluate a full range of options for improving water level regulation of the Great Lakes along with a thorough assessment of environmental, social, and economic impacts. The first report should be completed by early fall of 1987.

Authorization for an increased diversion at Chicago requires either an act of Congress or a modification to Illinois' United States Supreme Court Decree. Because the initiative for an increased diversion has been to provide water level relief on the Great Lakes, it is an international issue, and hence, inappropriate to bring before

the Supreme Court. It has been Illinois' position that any efforts to resolve the high lake level problem should involve all Great Lakes interests, both Canadian and American, and include all existing controlling measures which can impact on Great Lakes water levels. In addition, in response to the potential adverse impacts which have been described in previous studies of an increased diversion at Chicago, Illinois is opposed to an increased diversion until it can be clearly demonstrated that an operating plan can be developed to adequately protect interests on the Illinois waterway. The final section of this issue paper is a reprint of the State of Illinois' position on an increased diversion at Chicago, which was developed by staff in the Governor's office and the natural resource agencies. In keeping with that position, our efforts have focused on providing input and assistance to the continuing studies of the International Joint Commission and the Corps of Engineers to ensure that any operating plan for an increased diversion at Chicago provides maximum protection to our waterway interests.

In response to the high water level problem, several bills have been introduced in Congress which would authorize an increased diversion at Chicago. Recently, Congressman Sensenbrenner of Wisconsin and Congressman Porter from Illinois introduced a bill calling for the establishment of a comprehensive management program for the maintenance of water levels on the Great Lakes at approximately their long term averages. This bill also authorizes the immediate implementation of control measures on the U.S. side, including an increased diversion at Chicago. This bill contains safeguards to protect Illinois waterway interests, such as:

1. Increased diversion at Chicago would be accomplished incrementally, under the direct control and supervision of the Corps.
2. Places a ceiling of 10,000 cfs on increased diversion, and directs that increased diversion be reduced or stopped whenever bankfull conditions at established flood warning stations on the Illinois or Mississippi Rivers are predicted.
3. Directs the Corps to undertake a monitoring program to assess a full range of impacts of any increased diversion.

It is difficult to predict what Congress might do in response to the high water level problem on the Great Lakes. A very dry winter and spring have resulted in a significant drop in water levels on Lake Michigan and the other Great Lakes. One of our most important tasks will be to continue working with the International Joint Commission, the Corps of Engineers and our research agencies to continue collecting information on the potential impacts of an increased diversion and to carefully evaluate any revised operating plans so that should an increased diversion be authorized as part of a recommended plan of action between the federal, state and provincial governments that Illinois interests will be adequately protected.

STATE OF ILLINOIS POSITION ON LAKE MICHIGAN DIVERSION

This last section is a reprint of the official Illinois position on an increased diversion at Chicago that was developed in May 1987 in response to proposals calling for an increased diversion to provide relief from high Great Lakes water levels.

The problem of rising Great Lakes water levels has become a major issue. The environmental and economic impacts are substantial and clearly evident. Beach erosion due to storm action and high water levels has damaged miles of lakefront recreational areas. Homeowners all along the shoreline are trying to save their property from the encroaching lake. Exacerbating the situation is the fact that the lakes are soon expected to undergo their normal 10 to 15 inch spring increase.

There are clearly no quick fixes to this serious problem. Some people are advocating an increase in the Lake Michigan diversion at Chicago as the least costly method of "doing something" about the problem. However, increased diversion at Chicago, by itself, is not an effective solution. If implemented, this action would, over one year, reduce Lake Michigan by approximately one inch. This is an insignificant amount considering that the Lake is now about three feet above normal. At the same time, an increase in diversion at Chicago could have the following significant adverse impacts on the Illinois River Basin:

- flooding and associated damages to farmland in the Illinois River Valley,
- substantially increased pumping costs and capital costs to maintain levees, placed on drainage and levee districts,
- streambank erosion and sediment transport which is already a major problem in some areas along the River,
- demise of bottomland forests, loss of food for migratory waterfowl and breeding grounds for wildlife populations, reductions in recreational hunting, changes in the fish populations, and
- damages to the substantial amount of conservation and recreation land along the Illinois River owned by the State of Illinois, federal government and private hunt clubs.

These considerable impacts, coupled with the fact that increased Lake Michigan diversion would have a negligible positive impact on the Lake Michigan shoreline, prevent me from supporting increased diversion at this time.

However, while there are no quick fixes, the states and federal governments need to accelerate actions to mitigate future problems due to high lake levels. Several methods are available to help reduce wave action of Great Lakes water levels and thus shoreline damage. Bulkheads, revetments, breakwater walls, off-shore structures, and man-made off-shore islands are all effective but very expensive.

Some studies are currently underway, and others are needed. At Governor Thompson's request the Corps of Engineers was asked to begin studies under the Advanced Measures Program for protection of critical areas along Lake Michigan. Some of these projects are underway. The State of Illinois is providing the non-federal cash contribution for these projects and for several Section 14 Emergency Bank Stabilization Programs of the Corps along the Chicago shoreline in Rogers Park and Edgewater areas. Section 706 of the 1986 Water Resources Development Act (PL 99-662) provides for a Great Lakes Levels Study. This study will examine the impact of weather cycles on Lake levels and relationship of shoreline damage to the regulation of outflows from Lakes Superior and Erie. It will also yield recommendations for new or additional criteria for federal participation in shoreline protection projects along the Great Lakes and connecting channels.

For any solution to be developed, it is critical that efforts to resolve the high-lake level problem be shared by all Great Lakes interests, both Canadian and American, and involve all existing controlling measures which impact inflows and outflows on the Great Lakes. Flows can be further regulated at Long Lac/Ogoki, Niagara River, Welland Canal, and the Black Rock Lock.

Until it can be clearly demonstrated that an operating plan for an increased diversion can be developed which minimizes and mitigates adverse impacts on the Illinois waterway, the state is opposed to an increased diversion at Chicago. The Governor has, however, directed the appropriate State agencies to coordinate and provide assistance to the Corps of Engineers in their continuing study of an increased diversion at Chicago and in the study effort of the International Joint Commission.

RECREATION

INTRODUCTION

Illinois' rivers and valleys are becoming increasingly important as recreation resources. River areas display scenic overlooks and geologic formations, harbor rich archaeological sites, and historic river towns. The rivers, backwater lakes, and forested bottomlands provide excellent opportunity for a variety of recreation activities.

Recreation today is seen as a major segment of the economy. Diverse, high quality recreation opportunities are attractive to Illinois' citizens, prospective businesses, and tourists. The "Study of the Economic Significance of Recreation in Illinois," conducted by the Department of Conservation discovered the following facts. Illinois residents spent over \$6.3 billion in 1985 on recreation. The recreation industry in Illinois employs approximately 150,000 people. Recreation expenditures produced tax revenues of almost \$1.8 billion in 1985.

Recreation also enhances the quality of life. The Illinois River basin provides recreation in both quality and quantity, and the people of Illinois recognize it as a significant recreational resource. This report identifies ways to protect and improve this resource.

BACKGROUND

Recreation in the Illinois River basin includes water-dependent activities such as fishing, waterfowl hunting, boating, and swimming. Recreation also includes activities which are enhanced by proximity to water such as hiking, picnicking, and camping. These types of recreation are provided by local, State, and federal agencies such as park districts, forest preserve districts, the Department of Conservation, and the U.S. Fish and Wildlife Service. In addition, many private concerns provide similar recreation opportunities.

These recreation providers all offer similar recreation opportunities, each also having its recreation specialties. Often these providers produce recreation development plans independent of each other. This can result in an abundance of certain types of recreation, while under supplying other types of recreation. It can result in some areas with high concentrations of recreation sites, or areas with few recreation sites thus creating uneven distribution of recreation opportunities, or one provider having several widely spaced sites creating management difficulties. In short, the lack of cooperation among recreation providers in producing recreation development plans can be problematic and costly. In 1985, local, State, and federal agencies combined cost for providing recreation in Illinois was \$580 million.

A 1985 survey of Illinois residents showed that the most popular recreation activities in the State are bicycling, swimming, softball or baseball, and fishing. In the Illinois River basin, analyses of recreation use data show there is a strong need for more camping, trails, fishing, boating, swimming, and hunting opportunities.

In the Illinois River basin, many recreational sites and facilities are focused on the water -- rivers or lakes -- for recreation. In addition, wildlife habitat and forests are concentrated along the rivers and lakes of the basin. In urban areas, through urban waterfront renewal programs, riverfronts are being improved and made accessible to the public for recreation. Examples of riverfront development are Peoria's riverfront on the Illinois River and development on the Fox River at Elgin, Geneva, St. Charles, and the Rock River at Rockford.

Although there are many recreation providers and many recreation sites in the Illinois River basin, the largest percentage of land adjacent to rivers and lakes is in private ownership, and generally not accessible to the public for recreation. Levees have converted bottomlands to agricultural and urban development. According to the 1969 "Report for Recreational Development of Illinois River Backwater Areas," over forty percent of the bottomlands of the Illinois River were drained or leveed for agriculture. About 20 percent of the bottomlands are publicly owned or used for public recreation. Much of the remaining bottomland area is in urban and industrial use.

The list on the following page of Department of Conservation sites along the Illinois River illustrates the extent that the Illinois River and its tributaries and associated lakes contribute to recreation. This list is not comprehensive for the entire Illinois River Basin, but only the area contiguous to the Illinois River.

These water-related recreation sites are directly affected by the quality of the natural resource in and surrounding them--the rivers, lakes, backwater areas, forests, and geologic formations. Degradation of this resource is occurring at an alarming rate in the Illinois River basin. The natural resource is threatened by channelization, soil erosion, sedimentation, clearing of natural vegetation, and poor water quality. These problems are addressed in other sections of this report. They do, however, directly affect the quality and quantity of recreation available in the Illinois River basin.

It is unclear to what degree these problems are currently affecting recreation use. At some point, resource degradation reduces the quality of recreation and fewer people will use the resource for recreation. No data are available on the impact resource degradation currently has on the quality of water-related recreation use. It is known that, in general, recreation use is increasing in Illinois and this trend is expected to continue.

Illinois Department of Conservation Properties
in the Illinois River Corridor

<u>Facility</u>	<u>Acreage</u>
Pere Marquette State Park	7,320
Mississippi River Area Sites	
Calhoun Point Waterfowl Management Area	2,313
Stump Lake Waterfowl Management Area	2,950
Glades Access Area	1,454
Godar-Diamond Access Area	2,611
Hadley Landing Access Area	142
Pike County State Fish & Wildlife Area	862
Sanganois State Conservation Area	7,623
Anderson Lake State Conservation Area	2,133
Sand Ridge State Forest	7,180
Jack Wolf State Fish Hatchery	124
Rice Lake State Conservation Area	2,694
Banner Marsh State Fish & Wildlife Area	1,891
Spring Lake State Conservation Area	1,981
Powerton Lake State Fish & Wildlife Area (Leased)	1,429
Woodford County Conservation Area	2,901
Marshall County Conservation Area	3,245
Donnelley State Fish and Wildlife Area	280
Lake DePue State Fish and Wildlife Area	2,136
Matthiessen State Park	1,686
Starved Rock State Park	2,616
Buffalo Rock State Park	43
Illini State Park	510
LaSalle State Fish and Wildlife Area (Leased)	2,058
Heidecke Lake State Fish and Wildlife Area (Leased)	1,475
Gebhard Woods State Park	29
William G. Stratton State Park	6
Illinois & Michigan Canal State Park	2,668
Goose Lake Prairie State Park	2,435
TOTAL ACREAGE	64,795

The table that follows shows the attendance data for a representative sample of Department of Conservation sites on the Illinois River for 1981 to 1986. This table illustrates that most Department of Conservation sites on the Illinois River have experienced stable or increasing attendance in the 1981-1986 period.

1981-1986 Attendance in Thousands

	1981	1982	1983	1984	1985	1986
Banner Marsh	--	12	65	64	75	69
Buffalo Rock State Park	162	128	97	129	132	262
Lake Depue fish & Wildlife Area	--	--	25	43	68	83
Illini State Park	252	339	356	399	324	337
Pere Marquette State Park	1,052	1,087	1,084	1,236	1,290	1,406
Sanganois Conservation Area	19	27	22	23	31	40
Starved Rock State Park	1,255	1,257	1,197	1,157	1,170	1,269
Spring Lake Fish & Wildlife Area	332	306	314	307	256	203
Mississippi Pallasades State Park	734	468	433	634	688	698
Powerton Lake Fish & Wildlife Area	--	--	--	48	176	138
Matthiessen State Park	135	120	154	191	240	266
Rice Lake	113	145	153	157	140	136
	4,054	3,889	3,900	4,388	4,590	4,907

It should be noted, however, that some sites are experiencing declining attendance possibly due to degradation of the natural resource. It is clear that poor water quality is detrimental to swimming and fishing. Sedimentation is detrimental to boating, waterfowl hunting, and fishing. Erosion problems are detrimental to stream access for all of these water-related recreation activities.

ACTIVITIES, PROGRAMS, AND STUDIES

Recreational programs in the Department of Conservation can be categorized into four major types: management programs, grants to local governments, acquisition programs, and capital development projects. Management programs cover all areas of recreation including fisheries management, wildlife management, natural heritage management, and site management. These programs promote and regulate recreational use, monitor fish and wildlife populations, and improve fish and wildlife habitat on both public and private land.

Grant programs for local recreational development include the Open Space Land Acquisition and Development (OSLAD), the Land and Water Conservation Fund (L&WCF), the Boat Access Area Construction, and the Snowmobile Program grants. These grants are administered through the Department of Conservation and awarded to local governments. Snowmobile grants are available to both local governments and organized snowmobile clubs. All of these grants are 50% matching fund programs, except Boat Access Area grants and snowmobile grants to clubs, which are 100% grants. The boat access grants are for developing and improving boat access facilities on rivers and lakes. Snowmobile grants are for snowmobile trail development and maintenance. The other two grant programs (OSLAD and L&WCF) are broader in scope. Often these grant projects are multi-purpose

combining natural resource and open space preservation with development of recreational facilities. Examples of such projects are an interpretive trail in a natural area, swimming and fishing facilities on a lake, or stream bank stabilization to protect existing recreation facilities.

The third type of recreational program, acquisition programs, currently emphasize the acquisition of wildlife habitat and natural areas, due to the funding available through the Build Illinois Program. Their purpose is to acquire land--wildlife habitat and areas identified in the Illinois Natural Areas Inventory.

Related to the acquisition programs is the capital development program. The capital development program focuses on recreational development and improvements on existing State sites. The Park and Conservation Fund Program is a major capital development effort also funded through the Build Illinois Program. The types of projects included in this program are lodge and cabin improvements and expansion at State parks, new resort facilities at State parks, campground improvements and expansion, general recreation improvements, restoration of historic sites, park road improvements, and improvements at State game farms, tree nurseries, and fish hatcheries.

Status of Ongoing Programs

To date, \$11.6 million has been committed to the Open Space Land Acquisition and Development Program statewide. In 1987, \$460,000 was awarded to three municipalities in the Illinois River corridor. This money was used for a lake recreation area in Peru, riverfront development at Hennepin, and a swimming pool at Hardin. In 1986, \$151,000 was awarded through the Boat Access Area Construction Program to three communities in the Illinois River Corridor: Creve Coeur, Grafton, and Spring Valley.

The Build Illinois Wildlife Habitat Acquisition Program has committed \$8.5 million to date for habitat acquisition. Recent acquisitions include 789 acres of Illinois River bottomland at Banner Marsh State Fish and Wildlife Area, 2,952 acres (a former duck club) of Illinois River bottomland forest and backwater lakes at Rice Lake State Conservation Area, 728 acres at Pere Marquette State Park, and 115 acres at Sanganois State Conservation Area. Planned for 1988 is the purchase of 200 acres at Beardstown Marsh, an area of excellent bird habitat. Additional areas totaling about 400 acres have been targeted for purchase at Sanganois State Conservation Area. Two additional sites in the Illinois River basin have been identified as "areas of interest" for acquisition.

Also funded through Build Illinois was \$7 million provided for the Natural Areas Acquisition Program. There are currently twelve areas targeted for purchase within the Illinois River basin.

The capital development program includes the \$100 million Park and Conservation Fund Program to improve State site facilities. This program includes new resort facilities and lodge and cabin improvements at Pere Marquette State Park, which are expected to be completed in the spring of 1988. The total cost of this project is close to \$10 million. Renovation work is also being done on the lodge and cabins at Starved Rock State Park, and White Pines State Park at a total cost of \$5 million. Other projects in the Illinois River basin funded through this program include recreation development at I&M Canal State Park,

waterfowl area expansion at Lake Depue State Fish and Wildlife Area, and road and parking improvements at Donnelley State Fish and Wildlife Area.

The Department of Conservation along with other agencies is also currently involved with two trail projects within the Illinois River Corridor. These projects are the Illinois River Trail and the I&M Canal National Heritage Corridor. The National Park Service has completed a study and review of a proposal to designate the Illinois River and its associated waterways as a National Historic Trail. This would be a waterway trail, rather than a land trail.

The I&M Canal was recently designated by the National Park Service as a National Heritage Corridor. This is the first such corridor in the United States. An I&M National Heritage Corridor Commission was established to oversee management of the Corridor. Other organizations and agencies are involved through cooperative agreements, such as the Department of Transportation and the Cook County Forest Preserve District. In connection with this Corridor, the Metropolitan Sanitary District and others are pursuing a land trail along the canal. Portions of the trail have already been completed.

POSSIBLE COURSES OF ACTION

1. Coordinate local and State recreational development activities in order to complement their existing programs and goals. Local, regional, and State priorities for recreation development should be defined. Through coordination, these priorities should complement and enhance each other. Grant programs should increase priority given to applications related to the given local, regional, and State recreation priorities. Grant programs and recreational priorities should be related to other existing programs, such as Corridors of Opportunity, other Build Illinois efforts, and the Illinois River Road.
2. Continue the partnership approach of government and private interest groups, such as the Partners in Conservation effort, to promote cooperation between private interests and government toward mutually beneficial recreation developments. Work together to improve liability laws in Illinois and encourage opening of private land for public recreation.
3. Provide a stronger State presence in river corridor development in order to preserve fish and wildlife habitat and provide recreation access to natural resources now in private ownership. This would include implementation of the Illinois River Trail once designated as a National Historic Trail, and legislation to fund the Illinois River Road established in 1975.
4. Aggressively work to arrest the degradation of natural resources caused by erosion and sedimentation. Specific recommendations are included in other sections of this report. Demonstration projects and research should concentrate on protecting and enhancing the condition of natural resources at existing recreation sites thus protecting investments already made in existing sites.
5. The State should develop recreation opportunities that are not water-dependent at sites where the water resource has degraded to a degree that a quality water-related recreation opportunity is no longer available. The State should concentrate on developing multi-use recreation. Until the degradation

of the Illinois River basin's water resources can be addressed, other types of recreation can then be enjoyed at these multi-use sites.

6. Acquisition programs should concentrate on sites with quality natural resources. There are such opportunities available. Some such sites have already been identified. One example of such an area is a levee protected area. Some previously farmed areas once leveed and protected from floods, then abandoned, have also been protected from the degradation of sedimentation and water pollution. Another example is abandoned hunting clubs.

7. To establish priorities for acquisition programs and determine where the quality natural resources are, resource inventories and planning based on the resulting data should be undertaken. Some inventories have already begun: the Illinois Fish and Wildlife Information System identifying locations of species, the Illinois Streams Information System identifying the resources of stream corridors, and the Illinois Wetlands Inventory identifying the locations of wetlands. These inventories should be completed. The data can then be used to identify quality natural resources and set priorities for acquisition.

8. Visitor services and programs should be increased at existing recreation sites. This would include the addition of interpretive centers and staff, supervised recreation programs, dining facilities, and where appropriate, overnight facilities. Some of these facilities could be developed by the private sector.

9. Increase funding levels of selected current programs. The Wildlife Habitat Acquisition Program and the Natural Areas Acquisition Program should be funded at their originally planned levels.

10. Initiate a Statewide Greenways Program to focus resource protection, recreational development, and tourism promotion on Illinois' major greenways such as the Illinois River corridor.

COMMERCIAL NAVIGATION

INTRODUCTION

The State of Illinois offers a distinct geographic and economic advantage to shippers due to its Midwest location at the confluence of the Great Lakes and the inland waterway system. Ocean-going vessels provide direct service to the Port of Chicago from the Atlantic Ocean via the Great Lakes/St. Lawrence Seaway system, and barges operating on the inland waterway system provide service between Illinois and 17 other Midwest and Southern states, including the deep-draft ports of New Orleans and Baton Rouge.

The purpose of this paper is to provide an overview of the importance of barge shipping on the inland waterway system to the Illinois economy, the navigation features of the Illinois Waterway including constraints to barge shipping, and ongoing programs by federal and state agencies and a local community in studying ways to increase the commercial use of the inland waterway navigation system that are cost effective and environmentally sensitive. The paper presents possible courses of action to ensure that commercial navigation is compatible with other uses of the Illinois Waterway.

BACKGROUND

Inland Waterways in Illinois

Illinois has 1,116 miles of inland waterways, which represents about 14% of the nation's total of 7,000 miles of inland waterways with a depth of 9 to 12 feet. The Mississippi River forms the western border of the State for a distance of 581 miles, the Ohio River forms the southern border for 134 miles, and the Illinois Waterway, which includes the Illinois River and waterways in the Chicago area, bisects the State with 365 miles of waterway and provides the water link between the Great Lakes and the inland waterway system. In addition to these more well-known waterways, the Kaskaskia River in southwestern Illinois is navigable for a distance of 36 miles from the Mississippi River.

Locks and Dams

The length of the Ohio River from Pittsburgh almost to its confluence with the Mississippi River, the Illinois Waterway and the Mississippi River north of St. Louis are regulated by a series of locks and dams. The dams serve to maintain the depth of the water in the segment of the waterway behind the dam, and the locks form a passage through the dams to allow barges to be raised or lowered from one level to the next.

While the locks and dams are responsible for creating the pools that allow for commercial navigation, the locks can cause

bottlenecks that delay barge operations. Only the Mississippi River, from Locks 27 at Granite City south to the Gulf of Mexico, is not constrained by locks and dams.

Barges

The typical barge operating on the inland waterway system measures 195 feet in length, 35 feet in width and 12 feet high, and carries a maximum load of 1,500 tons of cargo. On the Illinois River, the size of tows is limited to 15 barges due to the size of the locks.

Barge transportation affords shippers of grain, coal, petroleum products, chemicals and other bulk commodities with a high capacity, low cost system to ship their products. For example, a tow of 15 barges operating on the Illinois River carries a maximum load of 22,500 tons of cargo, the equivalent of 225 railroad hopper cars or 900 truck trailers. An analysis of spot-market rates for the shipment of grain, in 1985, indicated the rate on a shipment of corn by barge from Peoria to New Orleans ranged from a low of 12 cents per bushel to a high of 27 cents per bushel. In comparison, the spot-market rate to ship all types of grain by rail averaged around 26 cents per bushel, and the rate was about \$1.19 per bushel to ship the grain by truck.

Terminal Facilities

A terminal is a cargo handling facility on a waterway which may include a dock, transfer equipment, storage area, landside access and other related cargo facilities. As of 1982, there were 344 terminals in operation on the waterway system in Illinois. Of this total, 317 terminals mainly handle barge traffic on the inland waterway system while 27 terminals handle overseas and Great Lakes vessels.

Tons of Barge Shipments

Barge shipments to and from Illinois increased from 70.3 million tons (tons of 2,000 pounds) in 1970 to a peak of 90.7 million tons in 1975, reached a second peak of 89.4 million tons in 1980, but fell to 81.6 million tons in 1983. Since 1970, Illinois has experienced a sharp increase in shipments of grain by barge, while shipments of coal and petroleum products have declined.

Grain shipments increased from 10.0 million tons in 1970, to 19.4 million tons in 1976, and then to 23.3 million tons in 1982, and fell to 21.9 million tons in 1983. Grain shipments by barge from Illinois increased during the decade of the 1970's in response to the rapid growth in U.S. grain exports, in which most of the grain moved by barge from Illinois and other Midwest states to the Gulf ports where it was loaded onto ocean vessels. However, shipments of grain by barge declined sharply following imposition of the embargo on grain sales to the USSR, the growth in exports from other world grain producing countries and rising levels of grain

production in developing countries that had previously been highly dependent upon foreign sources to sustain their populations.

Coal shipments by barge to and from Illinois fell from a peak of 28.1 million tons in 1975 to 21.0 million tons in 1983, and petroleum products fell from a peak of 16.7 million tons in 1974 to 11.5 million tons in 1983. Combined, these two commodities fell by 12.3 million tons from their peak years in the mid-1970's to 1983.

The decline in coal shipments by barge to and from Illinois is primarily attributed to a shift by utilities from the use of high sulfur coal mined in the Illinois basin to low sulfur western coal, which changed the delivery system from barges to railroads. The decline in barge shipments of petroleum products is the result of reduced refining capacity in Illinois and increased shipments of refined products by railroad and truck.

Features of the Illinois Waterway

The Illinois River has a history of navigation dating back to 1803. The construction of locks and dams began in 1871 and continued until the system, as we know it today, was completed in 1939. The Illinois Waterway consists of 365 miles of channels and has 9 locks and dams. The T. J. O'Brien Lock in Chicago measures 1,000' x 110', the Chicago Controlling Lock is 600' x 84', and the remaining seven locks measure 600' x 110'.

The physical features of the Illinois Waterway vary considerably from upper to lower reaches. The upper reach from Lockport to Starved Rock has a narrow channel and a relatively steep slope. The drop between Lockport and Starved Rock is 2.3 feet per mile. From Starved Rock to the mouth of the Illinois, the channel is wider and much flatter. The drop from Starved Rock to LaGrange is only about 1.6 inches per mile. These physical features impact tow traffic. The upper reaches have smaller tows than the lower channels, although this is not always due only to channel constraints.

The LaGrange and Peoria locks, the two southernmost locks on the Illinois River, have two of the four remaining wicket dams in the United States. These dams are made of large timbers that lay on the bottom of the river when flows are great enough to provide for a 9-foot channel. When the flows get low, the wickets are raised to create a dam. These wickets allow tows to by-pass the locks almost 50 percent of the time. Even though they are costly to maintain, they create significant efficiencies in transportation costs. In 1986, the wickets at Peoria were down 60 percent of the time. This allowed over 2,000 tows to pass by the lock, saving a total of more than 2,700 hours in processing time. The rehabilitation of the two locks will replace some of the wickets with a gate that will allow better control of the pool and allow ice to pass. This will relieve a dangerous condition when wickets must be lowered in the winter. Several times, Corps work boats have been upset and workers forced into the water when ice upstream has broken loose as the wickets were being raised or lowered. The gates will help to avoid this

extremely dangerous situation.

At Marseilles, the lock is about 2 miles downstream from the dam. The canal between the two is only 200 feet wide. This is too narrow to allow the passing of tows, so one must wait while another is in transit on the canal. About 65 percent of all tows encounter delays at Marseilles which average 3 hours. These delays will continue to increase in the future. Any solution to this problem will require not only efficiency studies, but environmental studies as well.

Above Lockport, the Sanitary and Ship Canal serves as the navigation channel. This canal is very narrow and it is congested in many places. Last improved 80 years ago, the canal was not designed for the type of equipment that uses it today.

Dredging on the Illinois is not a major problem. The average dredging is 169,000 cubic yards annually. The major problem area is at the mouth of the Mackinaw River. This area accounts for 25 percent of the average volume. Although small in volume, the location of disposal sites is a sensitive environmental problem that requires resolution.

Future Traffic Constraints

Future barge traffic on the Illinois Waterway will be limited by several constraints:

Marseilles Canal - The major constraint is the narrow canal at Marseilles. The existing delays which now average 3 hours per tow will continue to increase. Widening of the canal or the construction of a new canal may be needed to remove this constraint. In either case, an environmental impact statement would have to be prepared.

LaGrange Lock - The LaGrange Lock has the greatest traffic volume. However, since the wickets are down a large percent of the time, average delays are not excessive. There is a possibility though, that if there are some very dry years, this lock could then be a major constraint.

Capacity of the Locks - Past studies by the Army Corps of Engineers have identified major constraints at the locks as early as 1990. This can be extended to the year 2000 by use of non-structural measures. However, in order to handle traffic after that, decisions will have to be made on either restricting traffic or building new locks.

ACTIVITIES, PROGRAMS, STUDIES

Capacity Studies

Better information needs to be developed on the real capacity of the system. Studies are also required to determine the needs of the

system. What is the future demand and how could it best be met? There are minor modifications which can be done to more efficiently move traffic through the locks. There are also things that the towing industry can do to be more efficient. It is important to analyze these various measures in order to predict when the capacity of the various locks will be reached. With this information, we can then determine when and where problems will develop and make plans to solve them.

An update to the National Waterways Study, to be conducted by the Army Corps of Engineers, will provide updated traffic projections on which to base a determination of future lock capacity constraints. However, the state needs to be conducting independent studies of future traffic on the Illinois and Mississippi Rivers. These traffic projections should include such factors as the state's agricultural production capacity and coal or mineral mining capacities; the distribution of commodities among rail, barge and truck; and the future capacity of the state's rail system.

Environmental and Recreation Information

There is a need to obtain better environmental and recreation data. As future traffic makes more demands on the system, we must have a better understanding of the impacts. Commercial navigation is important to Illinois, but so is the natural environment of the river.

Impact studies of barge operations should address sediment resuspension and lateral movement, elevated average sediment concentration and turbidity, waves and drawdown caused by tows, and sediment input to side channels and backwaters. Careful field experiments can determine the impact of one tow and be combined with traffic predictions to assess impacts of increased navigation. Tow passage and fleeting and terminal area effects on mussel beds, fish spawning, and fish wintering habitats need to be determined. Certain areas already have safety problems because of high volumes of commercial and recreational traffic on confined waterways. Recreational activity must be projected and used to assist in siting terminal and fleeting areas. Any state efforts should complement research and monitoring conducted as part of the Army Corps of Engineers' Environmental Management Plan.

Ongoing Navigation Programs

This section presents navigation programs being conducted by the U.S. Army Corps of Engineers and the State of Illinois that may lead to increased shipments and to more efficient use of the inland waterway system serving Illinois. Also, an example is presented of local assistance in Dubuque, Iowa to the barge industry which was in need of additional fleeting space on the Mississippi River.

Army Corps of Engineers

Locks Rehabilitation Program - The ongoing locks rehabilitation program, and its related environmental document, should result in a better understanding of the existing conditions and provide short-term answers to some problems.

Environmental Management Program - This program is looking at a number of barge related issues including habitat rehabilitation and enhancement, a long-term resource monitoring program, a computerized inventory and analysis system, a traffic monitoring program and a program of recreation projects.

Update of the National Waterways Study - An Inland Waterways Review will update the data in the 1982 National Waterways Study to determine if any changes are required in its recommendations.

Study of Locks on the Upper Mississippi River - The Corps of Engineers is assisting the states of Illinois, Iowa, Wisconsin, Missouri, and Minnesota in a study of low cost non-structural measures to increase commercial navigation efficiencies. Although this study is on the Mississippi River, some of the findings may be applicable to the Illinois River.

Illinois Department of Transportation Programs

The Illinois Department of Transportation (IDOT) has taken an active role in the development of a coordinated intermodal freight transportation system serving the needs of manufacturing companies, farmers, mining operations, commercial enterprises and other users of railroad, truck and waterway shipping. This section of the paper discusses several of IDOT's programs in furthering the development of the inland waterway transportation system serving Illinois shippers.

Directory of Water Terminals - IDOT conducted a survey of existing terminals, and the survey results were published in the Directory of Lake and River Terminals in Illinois. For each of the terminals, the Directory includes such information as the terminal name, location, telephone, owner, contact person, tons of commodities handled, vessel loading/unloading capacity, storage capacity and railroad and/or truck access. The purpose of the Directory is to assist shippers in contacting terminals for the shipment of cargoes to and from Illinois.

Historic Database on Water Transportation - Recently, IDOT published a report entitled Illinois Waterborne Shipping Database. The report contains 63 tables that indicate the commodities and tonnages of waterborne shipments to and from the State of Illinois each year since 1970, and, in addition, includes tables on historic shipments for ports and waterways throughout the United States.

Forecasts of Barge Shipments - IDOT will be developing a series of projections of future shipments on the inland waterway system.

The methodology being used to develop barge forecasts will involve three major steps: 1) Identification of international, national and state production and consumption factors that will affect the need for water transport of coal, grain, fertilizer, petroleum products, sand and gravel and other commodities shipped by the river system; 2) Development of commodity forecasts specific to Illinois for those major commodity groups handled on the inland waterway system; and 3) Development of barge tonnage forecasts to and from the State for major commodities. When completed, the database will assist the State, port districts and the maritime industry in planning for needed port facilities and will provide an immediate source of comprehensive, timely and readily accessible data for investment decision-making and for responding to short-term economic development opportunities.

Role of Local Communities

Local communities along the waterway can play an important role in river transportation. The program conducted by a local government agency in Dubuque, Iowa is cited as an example of this type of activity.

The Dubuque Metropolitan Area Transportation Study assisted the barge industry in identifying sites for barge fleeting. Within the Dubuque area, the harbor service operators had been calling for more fleeting space on the Mississippi River, and other interest groups opposed the designation of almost all potential fleeting because aspects of fleeting detracted from their interests. This set the stage for the formation of an intergovernmental Ad-Hoc Fleeting Committee in August, 1985.

Several of the accomplishments of the Ad-Hoc Fleeting Committee which might be applicable to Illinois communities facing similar types of competing needs for riverfront uses, including fleeting, are as follows:

- o Developed a short term contingency plan enabling a response in event of a fleeting space emergency.
- o Promoted public awareness of the economic impact that the transportation industry, and barge fleeting, have on Dubuque and the tri-state area. This included an effort to develop interpretive panels or information kiosks that illustrate the past and present role of waterway commerce in Dubuque's development.
- o Encouraged long-term leases for fleet operators in order to meet the expected long-term growth in the demand for fleeting.

Impacts of the Water Resource Development Act of 1986

The U.S. Water Resource Development Act of 1986, PL 99-662, will have several significant long-term impacts on the national inland waterway system.

- o The Act created an Inland Waterway Users' Board composed of 11 shippers and users which will make recommendations regarding construction and rehabilitation priorities and spending levels for features and components of the inland waterways system.
- o The Act authorized the Upper Mississippi River Management Act of 1986. Its purpose is to assure the coordinated development and enhancement of the Upper Mississippi River System, of which the Illinois River is a part. It authorized a total of \$191,415,000 over a ten-year period to plan, construct and evaluate measures for fish and wildlife habitat, implement a long-term resource monitoring program, implement a computerized inventory and analysis system, implement a program of recreational projects, and conduct an assessment of economic benefits generated by recreational activities.
- o It authorized an increase in the fuel tax paid by towboat operators. The current tax of 10 cents per gallon will increase to 20 cents per gallon in steps between 1990 and 1995. These funds will be put into a trust fund to be used for capital improvements on the waterways.

CONCLUSION

The Illinois River is important to the State of Illinois and it is important as a national resource as well. There is a vital need to maintain commercial navigation on the river as a major economic resource and to maintain the river as a major environmental resource. This will require considerable effort in doing further studies and in planning. Through the efforts of all concerned, plans can be developed for the future of the Illinois River and to ensure its use as a balanced resource into the 21st century.

POSSIBLE COURSES OF ACTION

The navigation channel of the Illinois Waterway is maintained by the Army Corps of Engineers, and the Corps operates and maintains the locks and performs rehabilitation work on the locks as it becomes necessary. The costs of operating and maintaining the navigation system are 100 percent federally funded, and the cost of new locks is 50 percent federally funded and 50 percent funded from the fuel tax on barge operators. Because of this joint federal and private sharing of costs for the commercial navigation system, there is no need for the state or local communities along the waterways to contribute funds for these purposes.

There is the need to carefully study the potential impacts of future increased barge traffic on natural and recreational resources of the waterway. Following are recommended programs for the State and for communities along the waterway to ensure that barge operations are compatible with the environment, recreation uses and local riverfront development needs.

Environmental and Recreation Studies

While the Corps of Engineers has identified a worthwhile program of studies to assess the impacts of commercial navigation on the environment and on recreational uses of the Mississippi River and the Illinois Waterway, it is critical that the State have ample opportunities to monitor these studies and to review draft reports on study findings and recommendations. To achieve this oversight responsibility, it is recommended that:

- o IDOT be the lead State agency in notifying the Corps of the need for State involvement in ongoing and proposed studies of the impacts of commercial navigation on the environment and recreation uses of the Illinois Waterway.
- o IDOT coordinate its review activities with the Department of Energy and Natural Resources, Department of Conservation and other state agencies as needed.

Community Programs

Due to the contribution of commercial navigation activities to the economies of the communities along the Illinois Waterway, communities can undertake programs to ensure that future demand for riverfront lands by the barge industry and terminal developers are compatible with community needs and plans for future riverfront uses. Similar to the experience of the Dubuque Ad-Hoc Fleeting Committee, communities along the Illinois Waterway could conduct the following types of programs:

- o Identify riverfront sites suitable for fleeting, terminal development and other uses related to the barge industry including the disposal of dredged materials. Also, identify sensitive areas in which such development should be prohibited.
- o Establish a dialogue with barge terminals and barge operators by such means as ad-hoc committees to discuss the needs and problems of the barge industry and to reconcile problems between the industry and other local interests.
- o Develop public awareness programs to increase the public's understanding of the contribution of the barge industry to the economy of the local area and the State of Illinois.

DRINKING WATER SUPPLY

INTRODUCTION

Use of surface water within the Illinois river basin for public water supply purposes is limited. Only the Illinois American Water Company-Peoria Division uses the Illinois River to obtain a part of its raw water supply. With respect to public water supply needs, there are no major on-going water quality problems within the basin. In general, adequate water quality and quantity is available to meet public water supply demands. Those problems which do exist are transient or of a non-point nature (i.e., flooding, reservoir siltation and, to some extent, nitrates). Programs proposed elsewhere in this report will, if implemented, address possible solutions which should favorably impact on the needs of public water supplies within the basin.

BACKGROUND

There are 11 large and 15 relatively small public water supplies which rely on surface water sources within the Illinois River basin. Only the Illinois American Water Company-Peoria Division has a treatment plant which obtains water from the Illinois River. The Water Company is not totally dependent on the river as a source of supply as wells are used to supply a majority of the water demand. Generally, the river water treatment plant is used to meet the water demands during the warmer months. Water Supplies located on major tributaries of the Illinois River include the following:

Fox River - Elgin uses some water from the Fox River but also has wells. Both the river water and well water is treated at the same central treatment plant. The City of Aurora is planning to install a treatment plant which will use Fox River water along with water from the existing deep wells and shallow wells which are to be developed.

Kankakee River - The Kankakee Water Company uses the Kankakee River as a sole source of supply. The City's of Joliet and Wilmington have plans to construct water treatment plants which will treat Kankakee River water.

Vermilion River - Water treatment plants at Pontiac and Streator owned by the Northern Illinois Water Corp. obtain water from the Vermilion River.

Sangamon River - The City of Decatur has two water treatment plants which use water obtained from an impoundment of the Sangamon River. The Cities of Springfield and Taylorville both have impoundments on tributaries to the Sangamon River which are used for water supply purposes.

Minor Tributaries - The City of Jacksonville uses some surface water from impoundments on Mauvaise Teere Creek; however, most water is obtained from a groundwater collection system and wells located along the Illinois River. The City of Canton has a surface water treatment plant which obtains water from an impoundment on Copperas Creek. The ADGPTV Water Commission has a treatment plant which obtains water from an impoundment on Hodges Creek.

Surface Water is generally not used as a source of supply within the Illinois River Basin as there is sufficient groundwater within the area. Groundwater requires little or minimal treatment before delivery to the distribution system. Surface water, on the other hand, requires rather extensive and somewhat complex treatment in order to provide a safe, potable product. Many of the communities within the basin are quite small and would probably have difficulty in financing the construction and upkeep of a surface water treatment plant. This situation may, however, be changing due to the quality of groundwater available in a number of areas within the Illinois River basin. Frequently, groundwater in this area exceeds the drinking water standard for radium. Communities may find it is cost effective to develop a regional public water supply which uses surface water and serves a large area. The communities may find this type of regional system is much less expensive to construct and operate when compared to installation and operation of individual treatment plants which remove radium.

The public water supplies within the basin which have impoundments on the tributaries are faced with siltation problems. Four communities within the basin which use surface water occasionally experience excursions above the nitrate standard for drinking water. On the other hand, none of the public water supplies which use surface water within the basin are experiencing problems with pesticides nor have there been problems with volatile organic compounds. The siltation problem is being addressed by some of the communities. Bloomington, for example, has installed an additional reservoir in order to keep up with the projected water demands. Decatur has plans for dredging of their lake and are investigating other means to supplement raw water needs. Springfield has initiated a dredging program in the upper reaches of Lake Springfield. As mentioned, there are four communities within the basin which have nitrate levels which exceed the drinking water standards periodically. Public water supply officials provide public notice and work closely with the medical community in advising parents with children under 18 months of age. While the nitrate levels in these communities do not significantly exceed the standard, the parents are advised as to the steps which need to be taken in providing an alternate source of water for their infants.

ACTIVITIES, PROGRAMS, AND STUDIES

Illinois has had a public water supply program since about the turn of the century. The public water supply program in Illinois is administered by the Illinois EPA under regulations adopted by the Illinois Pollution Control Board. Illinois has also received primary enforcement authority (primacy) for the administration of the Safe Drinking Water Act (SDWA) from the USEPA. The Illinois Pollution Control Board has adopted regulations at least as stringent as those of the SDWA. All public water supplies are evaluated by IEPA on a routine basis to assure conformance with the Board regulations. As deviations from Board regulations are found during the inspection, evaluation and monitoring process, recommendations are made to water supply officials for necessary correction. If needed, enforcement actions are also taken to bring about compliance with the regulations. Raw and finished water samples are routinely submitted from each public water supply as a part of a monitoring program and are analyzed to determine: microbiological quality; inorganic and organic chemical quality; physical quality; and radiological quality. Public notification via the news media is required whenever there is violation of a drinking water standard or a monitoring/reporting requirement. The number of water quality constituents regulated by drinking water standards will be increased from 34 to 81 by 1989 as provided for under the SDWA Amendments of 1986.

The IEPA public water supply program differs from other Agency media programs. The Illinois Environmental Protection Act and the Board regulations are directed toward the actions water supply officials must take in the provision of a safe, potable water. Accordingly, the public water supply program relies heavily on other programs to provide relief from area wide adverse water quality impacts. Although the Illinois Municipal Code provides that public water supply officials can take legal action whenever the source of supply (either ground or surface water) is contaminated, this course of action may be somewhat cumbersome for local officials. Resolution of problems through this process would usually require development or retention of expertise needed to successfully prosecute a case.

POSSIBLE COURSES OF ACTION

Surface water supplies within the basin are not experiencing major water quality problems. The Illinois American Water Company-Peoria Division operates the only public water supply which uses Illinois River water and even so does not rely entirely on the River as a sole source of supply. Groundwater is used to provide the majority (approximately one half to two thirds, depending on the season) of the water needs while the surface water plant is used to supplement during peak usage periods. Major problems with water quality have not routinely been experienced. However, one such infrequent instance did occur during 1985 when extremely low river flows were coupled with a bloom of microorganisms which resulted in severe taste and odor problems for a time. The surface water treatment plant is provided equipment and facilities which adequately treat and provide a safe, potable water. Safe in that the water meets or exceeds drinking water standards; potable in that the water is not objectionable to sight, taste, or smell. Similarly, quantity

has not been an issue for purposes of supplying water to the Peoria service area. In fact, the water company plans to further expand the availability of water to areas outside the city. A problem being anticipated if Peoria Lake siltation becomes as severe as predicted is hinderence of operation due to excess turbidity brought about by barge traffic. However, this is not a problem at the present time.

Problems with reservoir siltation and periodic excursions above the nitrate standard at several water supplies are more of a non-point source problem and are being addressed in the other areas of study. As these programs are phased in and controls are implemented, benefits to the water supply program will accrue.

The surface water supplies within the basin could be used as reference points to gauge the effectiveness of control programs. As examples: a water supply intake could be used as a water quality monitoring station; reservoirs could be used to gauge the effectiveness of erosion control measures being implemented; and use of reservoirs to pilot techniques for control of algae and other microorganisms as this relates to reduction in nutrient loadings for surface waters.

WASTEWATER DISPOSAL

INTRODUCTION

Utilization of the Illinois River for waste disposal is one of the numerous uses found in the system. Concerns about health and negative recreational impacts due to waste discharge are concerns of all users of the Illinois River.

BACKGROUND

The Illinois River is a major conduit for the transport of treated waste throughout Illinois. It is estimated that 2,109 outfalls are located in the Illinois River Basin today. Illinois has taken great efforts to obtain compliance with effluent limitations by dischargers in the basin. From the municipal facility perspective, the State and Federal government has expended \$2.3 billion for treatment facility construction in the Illinois River Basin alone. It can be safely estimated that several hundred million dollars have also been expended by industrial dischargers.

The majority of expended funds have been through the Federal Water Pollution Control Act, Section 201, Construction Grants Program. In addition to these funds, the State established grant funds through the Illinois Anti-Pollution Bond Act of 1970. In a comparable role with these funding programs, Governor Thompson's Build Illinois Program has infused another \$27 plus million into major wastewater programs. The largest discharger in the Illinois River Basin System is the Metropolitan Sanitary District of Greater Chicago (MSDGC). It is estimated that over \$11 billion dollars in local, state and federal funds has gone towards wastewater control in this area since 1970. One project alone, the TARP Tunnel, has significantly modified the impacts of combined sewage and stormwater in the Illinois River Basin System. This is important as the combined sewer overflow from the MSDGC was estimated to be 75% of the total BOD₅ load from this area into the receiving streams. When considering just the main stem of the Illinois River, several other major sewage contributions have also realized increased treatment capabilities. These contributors include: Lockport, Joliet, Morris, Ottawa, LaSalle, Peru, Chillicothe, Peoria, and Beardstown. Review of the entire basin finds the majority of the larger municipalities and an overwhelming majority of the State's population. This information speaks for the need to continue to properly manage waste treatment systems in the basin if we are to be able to focus efforts into nonpoint source pollution control needs in the watershed.

ACTIVITIES, PROGRAMS, AND STUDIES

The activity of waste disposal is closely regulated through State and Federal Regulations. The procedures for issuance of National Pollution Discharge Elimination System (NPDES) permits are established through a memorandum of agreement with the USEPA; the regulations under 40 CFR 122, 123, 124, and 125; and the Illinois Administrative Code, Title 35, Environmental Protection. Dredge and fill operations are regulated through Corps of Engineers 401/404

review. The sludge program issues permits through Illinois Administrative Code, Title 35, Chapter 1, Section 309.204. Other Illinois Pollution Control Board Rules and Regulations which address other waste/residue disposal also exist. These regulations, in conjunction with ongoing programs to evaluate or establish water quality standards in Illinois, continue to improve and expand upon the effectiveness of waste disposal management throughout the State.

For industrial facilities, the IEPA is committed to utilizing available resources to further implement a pretreatment program that complies with the intent of the Clean Water Act and 40 CFR 403 (General Pretreatment Regulations). The IEPA has required, through intensive reviews and guidance, facility compliance with all the federal requirements. Highlights to this program include; 1) Utilizing Permit, Grant and Compliance mechanisms in the development of a pretreatment program and requirements to meet federal guidelines; 2) Guidance through numerous seminars and written document; 3) Requiring the development and enforcement of local limits to protect the treatment process, water quality and compliance with NPDES limits including a State permit process for sludge disposal.

In addition to the "traditional" programs for management/regulation of waste disposal, the IEPA has ongoing programs in the field of Toxic Substance Control, the USEPA's National Dioxin Study, fish contaminant monitoring, and sludge management and disposal:

Toxic Substance Control -- The major elements of the program include: 1) Development of a multimedia approach for dealing with toxic substances, 2) Development of reliable and accurate methods for measuring the significance of toxic substances in the environment; 3) Identification of appropriate and enforceable standards and controls for toxic substances found to be a problem in Illinois waters.

National Dioxin Study -- The IEPA in conjunction with the USEPA is conducting follow-up sampling for fish in areas where detectable levels of Dioxin have been identified.

Fish Contaminant Monitoring -- The IEPA participates in a cooperative multi-Agency effort to monitor fish flesh sampling and testing for toxic, and assists in the issuance of fish consumption warning throughout the Illinois River Basin and the State.

Sludge Management -- The IEPA regulates the sludge management strategies through the State's permit process. This program will allow the IEPA to actively encourage the recycling of POTW (Publicly Owned Treatment Works) generated sludge. The IEPA will carefully review the sludge treatment and solids handling capacities of POTW's. This will not only insure good handling practice, but will aid with the POTW achieving compliance with the effluent limitations established in their NPDES permits.

POSSIBLE COURSES OF ACTION

Review of waste disposal conditions in the Illinois River basin finds:

- Effective, enforceable, long-term programs are in place and keeping pace with new concerns and technologies.
- Continued vigilance is needed in the administration of State and Federal regulations. Review of the utilization of Administrative Authority in the control of land pollution at the IEPA, and Administrative Order Authority at the USEPA, indicates that the procedural streamlining and effectiveness of such authority would enhance the IEPA's administrative efforts.
- Development of effective water quality standards must keep pace with new constituents.
- Continued financial support through State infrastructural funding and/or a revolving loan program is needed to help communities defray the costs of compliance with NPDES limits.
- Local initiatives in improvement of operation and management of facilities including refinancing, and "policing" of significant users is needed to reduce excursions from effluent limits.

HYDROPOWER

INTRODUCTION

Hydropower was dubbed "an energy source whose time has come again" in a 1980 report by the Comptroller General of the United States to the Congress. Hydropower potential exists at many low dams and it can save the country hundreds of thousands of barrels of oil per day. However, problems and constraints -- economic, environmental, institutional, and operational -- must be carefully investigated to determine the suitability and feasibility of hydropower development at a site. The Federal Energy Regulatory Commission (FERC) estimated the potential capacity at 110,000 megawatts (MW) for sites with power potential over 5 MW each. Hydropower is one of Illinois' largely untapped renewable resources.

The Federal Water Power Act gave the Federal Power Commission, now FERC, responsibility for licensing all non-federal hydroelectric power projects. The regional electrical companies serving the area are required by the Public Utilities Regulatory Act to purchase the power if other buyers cannot be found. In Illinois, potential sale price of the power will be specified by the Illinois Commerce Commission. At present, hydropower is being generated at the Lockport and Marseilles locks and dams on the Illinois River. Other locks and dams for possible hydropower development are at Brandon Road, Dresden Island, Starved Rock, Peoria, and La Grange. There is potential for increasing the capacity at Marseilles Lock and Dam.

BACKGROUND

Hydropower is one of Illinois' largely untapped renewable resources. With the recent advances in low-head hydropower technology, this resource can provide close to one percent of the power needed in Illinois. However, at the present time, hydropower accounts for only about one-fifth of that potential. Increased cost of fossil fuels and adverse impacts of their use on air and water quality have rejuvenated the interest in hydropower.

The U.S. Department of Energy, DOE, initiated several programs in the 1970s to promote the development of small-scale or low-head hydropower. The Federal Energy Regulatory Commission, FERC, streamlined the regulatory process for such projects. In 1978, the Illinois Institute of Natural Resources (now the Department of Energy and Natural Resources, DENR) initiated studies to assess the potential for small-scale hydropower generation. A study conducted by Wapora, Inc., listed six hydroelectric generating facilities operating in Illinois.

<u>Facility location</u>	<u>River</u>	<u>Net head (feet)</u>	<u>Existing capacity (megawatts)</u>
1. Marseilles	Illinois River	14	2.3
2. Lockport	Chicago Sanitary and Ship Canal	38	17.0
3. Dixon	Rock River	9	4.0
4. Rockton	Rock River	15	1.1
5. Dayton	Fox River	28	4.0
6. Moline	Sylvan Slough	9	3.6
			32.0

Hydropower potential in Illinois is limited because of low hydraulic heads and seasonal variability of streamflow. The hydroelectric generating capacity decreased from 48 MW in the early 1950s to 44 MW in 1960, 43 MW in 1968, and 32 MW in 1978. The Illinois Division of Waterways attributed the decay in hydropower generation to small and uneconomical size of plants, excessive operation and maintenance costs, and relatively cheap and abundant power from steam-electric plants.

In 1979, the U.S. Corps of Engineers completed a preliminary inventory of hydropower resources. This inventory lists 303 sites (including existing generating sites in Illinois) with and without dams that have a potential generating capacity of at least 50 kilowatts (kw). Dam and flow data are available at 57 of the 303 sites. Construction of hydropower generating facilities at sites without dams will be very expensive and will pose significant environmental problems. Combined generating capacity at the 57 sites is estimated to be approximately 176 MW. The sites on the Illinois River and Des Plaines River (from confluence with the Kankakee River to Lockport) are:

<u>Site</u>	<u>Estimated capacity, MW</u>
Lockport Dam, existing	17.0
Brandon Road Dam	9.9
Dresden Island Dam	7.7
Marseilles Dam, existing	2.3
Marseilles Dam, proposed plant	10.2
Starved Rock Dam	15.8
Peoria Dam	8.7
La Grange Dam	12.2

Thus the hydropower generating capacity can be increased from the existing 19.3 MW to 83.8 MW. A megawatt of capacity can meet the electrical needs of 1,000 to 2,000 people. Fifteen of the 21 sites originally identified by Wapora, Inc. in 1982 have already been studied. The studies for the sites with larger capacities indicate that development is economically feasible.

Typically all hydropower plants have a dam to direct water through a power house containing mechanical and electrical generating equipment. The dam increases the net hydraulic head and permits regulation of the flows to moderate the flow variability.

Dams are built across streams and rivers for various purposes, including navigation, water supply, hydropower, and recreation. They affect water quality in terms of dissolved oxygen (DO) levels. There can be both positive and negative effects. Construction of a dam creates backwaters with higher depths and lower flow velocities than exist without the dam. This generally leads to a decrease in DO levels (reaeration is directly related to stream velocity and inversely related to depth) and accumulation of sediments (pollution strains stream DO resources still more) in the pool. Water flowing over the spillway crest or weir causes a significant increase in DO, but releases from the dam through pipes laid near the pool bottom depress DO levels downstream during summers with low flows and high temperatures. The predominant fish and the organisms they feed on have been classified by the prevalent DO levels in a stream. Warm-water game fish need sustained DO levels of 5 mg/l or higher, other game fish such as walleye and northern pike need 6 mg/l or higher, and rough fish such as buffalo fish and drum exist comfortably in the 2-4 mg/l range.

The Illinois Waterway comprises the Illinois River from its confluence with the Mississippi River upstream to its confluence with the Kankakee River, and the Des Plaines River from its confluence with the Kankakee River upstream to Lockport and thence to Lake Michigan. During dry weather, the upper portion consists mainly of treated wastewater effluents diluted with water diverted from Lake Michigan. There are seven locks and dams at Lockport, Brandon Road, Dresden Island, Marseilles, Starved Rock, Peoria, and La Grange. These dams create eight navigation pools extending over the entire waterway of 327 miles length. The Illinois Waterway profile is shown in Figure 1. When flow is passed through penstocks for generating power, there is little aeration of the water passing through the turbines. Laboratory and field tests have been conducted throughout U.S.A. to include in the design and operation of dams such measures as to maintain reasonable levels of DOs upstream and downstream of the locks and dams. However, such measures have not generally been used on the existing dams.

The operation of navigation locks and dams may need some modification during the periods when river flow exceeds the lockage requirements. The literature search did not show any discussion of this aspect. Another concern will be the change in sediment transport because of low-head hydroplants. Relevant information for the Illinois River is not available.

ACTIVITIES, PROGRAMS, AND STUDIES

A preliminary inventory of hydropower resources overstated the estimated hydropower capacity because the following factors were ignored: reduction in head due to rising tailwater during high

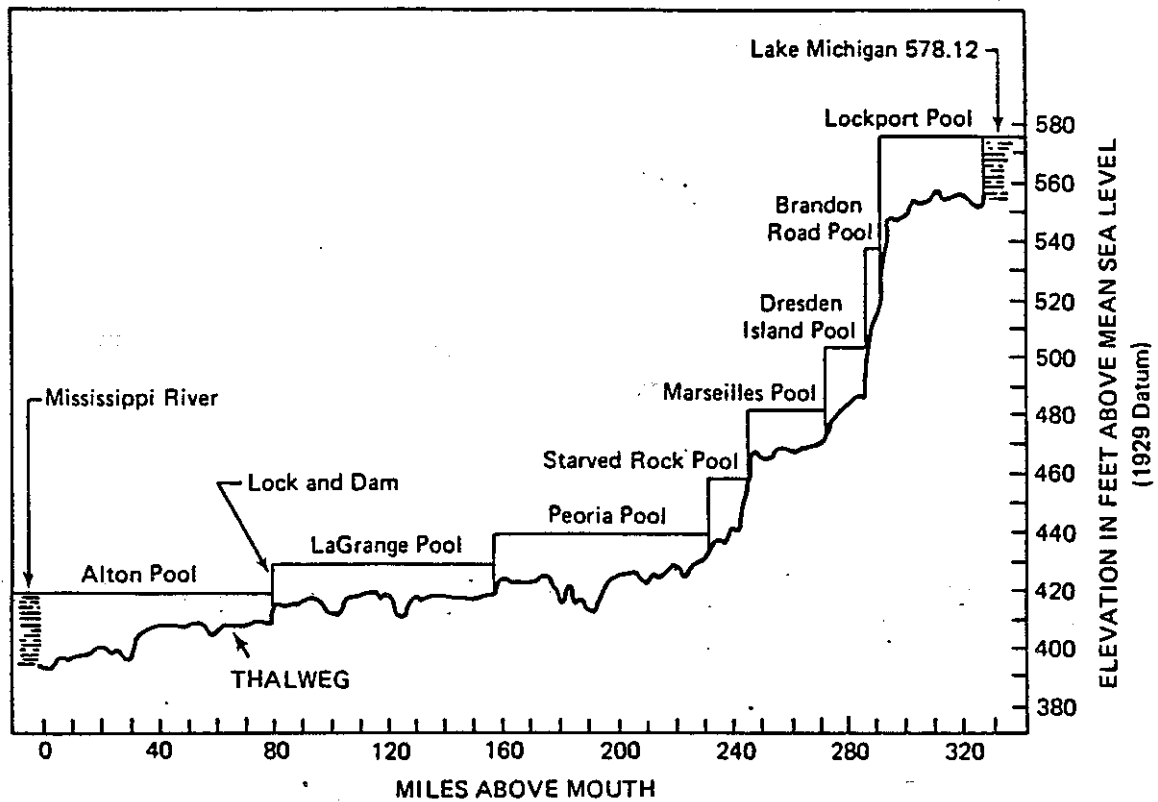


Figure 1. Illinois Waterway Profile

flows; diversions of flow for other uses, and evaporation losses, head losses, and turbine efficiency; shut-down during high flows; and environmental and social constraints. Detailed site-specific studies are expected to cover these deficiencies. The Corps of Engineers prepared a reconnaissance report on the hydropower potential of locks and dams 12, 13, 15, 16, 17, 18, 20, 21, and 22 on the Mississippi River because the national hydropower study indicated that power production at these dams might be economically feasible. Several different-sized plants were economically evaluated for each dam site. At locks and dams 12 and 17, none of the power plants evaluated were economically justified. The remaining locks and dams had some size of power production that is economically justified and could make a contribution to national energy independence.

The Corps of Engineers investigated the feasibility of developing hydropower at the seven locks and dams on the Illinois River during the period from the late 1970s to the early 1980s. Hydropower development was found to be economically justified at the Brandon Road, Dresden Island, Marseilles (a new additional plant), and Starved Rock locks and dams. The power plant at Lockport is already being operated by the Metropolitan Sanitary District of Greater Chicago, MSDGC. Power generation at Peoria and La Grange locks and dams is not economically feasible because of rather low hydraulic heads and wicket-gate operation. The recent Corps reports give the following information:

<u>Lock and dam</u>	<u>Capacity, MW</u>
Brandon Road	9.9
Dresden Island	12.0
Marseilles	10.4
Starved Rock	15.0

Wapora, Inc. conducted a preliminary investigation of small-scale hydropower potential at five sites in Illinois for the Illinois Institute of Natural Resources. The five sites selected were the Oregon Dam on the Rock River at Oregon, the Upper Sterling Dam on the Rock River at Sterling-Rock Falls, the Wilmington Dam on the Kankakee River at Wilmington, the Kankakee Dam on the Kankakee River at Kankakee, and the Elgin Dam on the Fox River at Elgin. Main findings are: flow and head at each site are adequate to generate electrical energy, all the dams are in good condition (with the exception of the Elgin dam), existing power house structures or substructures can be utilized, redevelopment of hydropower at these sites will have few environmental consequences, and development of each site by a private entity seems to be infeasible. It is interesting to note that, with the exception of the Elgin site with the smallest potential capacity, all the sites are in various stages of project planning. The Oregon and Wilmington sites have received preliminary permits; Rock Falls has been exempted from licensing and the powerplant is under construction; and Kankakee has applied for a license. Development efforts are all being made by the municipal officials.

For small-scale hydropower development, the developer has to apply to the Federal Energy Regulatory Commission (FERC) for a preliminary permit that is valid for 3 years and allows the developer time to get power potential, economic feasibility, and other relevant factors investigated and assessed. During this period no one else is issued a preliminary permit for the same site. At the expiration of the permit, the developer can apply for a license or for exemption from licensing if he wants to go ahead with detailed design and construction. These applications so far have been for sites with existing dams, locks and dams, or other control structures. It has been the administration policy to give permits to non-federal and private entities. This preference has kept the Corps of Engineers and other federal agencies from undertaking small-scale or low-head hydropower development even at the dams owned by them.

According to the FERC, nine preliminary permits have been issued (three on the Mississippi River locks and dams 18, 21, and 25; one near Benton on the Big Muddy River; one near Oregon on the Rock River; one near Carlyle (Carlyle Hydro Associates) at Carlyle Lock and Dam; one at Marseilles Lock and Dam on the Illinois River; one near Wilmington on the Kankakee River; and one for Kaskaskia River (Randolph Associates) at the Kaskaskia Lock and Dam). Two applicants have been exempted from licensing: Mr. & Mrs. M. White (Sears Project), and Rock River and City of Rock Falls (Upper Sterling Dam on Rock River). Five applications for licenses are pending (Rockdale Village -- Brandon Road Lock and Dam; Channahon Village -- Dresden Island Lock and Dam; Peru City -- Starved Rock Lock and Dam; Kankakee City -- Kankakee Dam; and LeClaire, Iowa plant on the Illinois side -- Lock and Dam 14, Mississippi River).

Environmental Concerns

In 1981, Loar and Sale investigated the environmental concerns associated with small-scale hydropower development, particularly the instream flow needs. Establishment of a protected instream flow regime can significantly affect the economic feasibility of small-scale hydropower projects because water needed to provide instream flows is often not available for power production. In addition to this report, four reports have been issued by Oak Ridge National Laboratory on analysis of environmental issues related to small-scale hydropower development, design considerations for passing fish upstream around dams, environmental concerns related to water level fluctuations, and fish mortality resulting from turbine passage.

Techniques for reaeration of hydropower releases are a major concern for regulated rivers such as the Illinois River. Two major categories of hydropower reaeration systems are turbine venting and aeration in the reservoir. Turbine venting covers oxygen diffusers in the turbine flow, air aspiration into the draft tube below the turbine wheel, and mechanical injection with the use of compressors. About a 2 to 4 mg/l increase in dissolved oxygen can be achieved. Reservoir aeration with high-purity oxygen injection was found to be effective. This is capital-intensive but does not reduce turbine

efficiency as does turbine venting. An economic evaluation is necessary to choose one of the other technique.

Tailwater fishing is a popular recreational activity below the small-scale hydroplants such as those proposed on the Illinois River. Their proposed design should, therefore, include consideration of fish screens and fish passage facilities. The design must also not change the sediment flow and deposition patterns to the detriment of water quality and aquatic habitats.

CONCLUSIONS

The following conclusions are drawn regarding the suitability and feasibility of further hydropower development at the existing sites in the Illinois River Basin.

1. Detailed hydrologic analyses are always required and operational constraints must be fully determined to make a satisfactory estimate of hydropower potential at any site.
2. Environmental concerns must be identified as well as suitable measures and related costs to reduce the adverse impacts, such as low dissolved oxygen, to a minimum.
3. Thorough economic analyses must always be carried out, with consideration given to both tangible and intangible costs and benefits, to determine the true economic feasibility of hydropower development at a site.
4. For orderly hydropower development, in line with state objectives and goals, cooperation and communication between FERC and the State must continue in the issuing of any permits.

POSSIBLE COURSES OF ACTION

The feasibility of hydropower development at some of the existing locks and dams in the Illinois River Basin must continue to be determined through exhaustive hydrologic analyses, knowledge of operational constraints and of environmental impacts that will need mitigation, and economic analyses considering all tangible and intangible costs. The following actions are suggested to achieve the true economic hydropower development in a manner consistent with the goals and objectives of the State.

1. Conduct full hydrologic analyses: All projects should have analyses that include development of daily flow series at the site for 25 years or more, weekly dissolved oxygen and mean temperature values, and monthly values of desired protected or instream flows. The upstream and downstream water stage series should always be developed to calculate the available head.

2. Evaluate the full environmental impacts: Impacts in terms of reduction in dissolved oxygen, reaeration, aquatic habitat, and fish passageways should be investigated in detail. Suitable remedial measures should be identified and their costs determined. Any changes in sediment transport and sedimentation must be investigated and measures to mitigate any adverse impacts be identified.
3. Conduct a thorough economic analyses: These must always be carried out for various values of hydropower capacity that can be developed at the site. Both tangible costs and intangible costs and benefits must be considered to the highest degree possible, to determine the true economic feasibility of a proposed project.

AGRICULTURE

INTRODUCTION

There are an estimated 41,684 farms contained within Illinois' portion of the Illinois River Basin. The average size of each of these farms is 314 acres. In 1985 each of these farms realized an average net income of \$16,563 after expenses, a marked increase over the 1984 net income after expenses of \$4,096. This provides an example of the volatile economic climate within which farmers must operate.

Statewide, the number of farms has declined steadily from 253,000 in 1910 when records began, to 87,000 in 1986. The largest loss in farm numbers occurred between the years 1982 and 1985 with the loss of 14,000 farms. These figures provide the basis for the argument that if farmers are to remain competitive, they must become better managers and adopt the most cost effective methods of production available.

The issue of encouraging farmers to adopt better and more environmentally conscious cropping practices was among a number of issues that were raised at the April 1-3, 1987 Governor's Conference on the Illinois River.

The purpose of this paper is to provide insight into some of the farming practices and programs that farmers are adopting.

BACKGROUND

The evolution of agriculture in Illinois has been based on production. History has shown that when innovations, such as the self scouring plow, the steam engine, internal combustion powered tractors, hybrid seed, fertilizers, and chemical pesticides, would allow the farmer to increase his production while maintaining or reducing his labor requirements, the farmer readily adopted those innovations.

The adoption of newer innovations and farming methods made farmers more efficient. They were able to produce more crops on greater acreages without significant increases in labor requirements. As farmers became more efficient, they had more spendable income. That income was used to trade horsepower for mechanization and to purchase more land. Statewide, average farm size has increased from 150 acres in 1950 to 330 acres in 1986.

The end result of this efficiency is that large amounts of acreages were no longer needed to produce food for work animals. Fields used for hay or grazing, and protected from soil erosion through a cover crop in a crop rotation or through permanent cover in pasture, were plowed up and put to continuous row crops in an effort to further increase production and thus increase farm income.

Though no detailed discussion of livestock production is presented in this paper, it will be mentioned as a contributor to conditions as they currently exist in the Illinois River Basin.

During this head long rush to remain competitive by becoming more efficient, there were of course areas that remained in a forage producing land use. Steepness of slope and other characteristics which made these lands unsuitable for row crop production led to their use as grazing areas for ever increasing numbers of livestock. Increasing efficiency in feed grain production led to farmers' realization that they could become more efficient in producing livestock as well by placing large concentrations of animals on these lands and supplementing their forage intake with surplus feed grains. These concentrations of animals frequently exceeded the carrying capacity of the land. The vegetative cover was reduced to the point where it would no longer protect the soil and erosion occurred.

Recently however, this trend toward all out production is being reversed. Decreasing land values, increasing fuel, machinery, materials and labor costs, and depressed commodity prices have combined to force farmers to pay more attention to the net return rather than the gross return on their investment in materials and labor. Farmers are responding to this situation by adopting conservation tillage practices. Table 1 provides a Soil and Water Conservation District summary of the number of farms, acreage in farms, average farm size, acres of cropland in farms and percent of conservation tilled cropland within the Illinois River Basin.

TABLE 1
FARMS AND CROPLAND ACRES WITHIN THE
ILLINOIS RIVER BASIN BY SOIL AND
WATER CONSERVATION DISTRICT (SWCD)

<u>SWCD</u>	<u>No. Farms in Basin</u>	<u>Farm Basin Acreage</u>	<u>County Avg. Farm Size</u>	<u>Basin Cropland</u>	<u>* % of Total Cropland in Cons. Tillage</u>
Adams	562	153,426	273	116,366	37%
Brown	481	151,881	316	101,482	12%
Bureau	1,091	342,574	314	300,136	64%
Calhoun	300	61,200	204	34,828	41%
Cass	550	220,464	401	177,044	46%
Champaign	428	137,388	321	132,073	21%
Christian	1,131	401,505	355	372,795	9%
DeKalb	454	156,176	344	146,236	58%

<u>SWCD</u>	<u>No. Farms in Basin</u>	<u>Farm Basin Acreage</u>	<u>County Avg. Farm Size</u>	<u>Basin Cropland</u>	<u>* % of Total Cropland in Cons. Tillage</u>
DeWitt	629	215,847	343	204,617	27%
Ford	512	184,320	360	175,727	68%
Fulton	1,440	422,041	293	299,473	30%
Greene	912	312,325	342	238,845	39%
Grundy	606	228,168	377	208,811	48%
Hancock	774	225,234	291	183,797	46%
Henderson	20	7,520	376	6,243	44%
Henry	115	30,705	267	27,438	40%
Iroquois	1,899	679,721	358	637,058	52%
Jersey	582	159,468	274	118,596	40%
Kane-DuPage	760	185,440	244	166,195	55%
Kankakee	1,173	379,052	323	357,315	27%
Kendall	616	186,139	302	171,174	18%
Knox	1,089	340,857	313	272,380	37%
Lake	513	92,135	180	76,455	48%
LaSalle	2,146	637,108	297	584,573	34%
Lee	173	58,880	341	54,304	48%
Livingston	1,835	627,653	342	594,562	47%
Logan	1,024	364,230	356	342,575	61%
Macon	875	310,625	355	295,638	26%
Macoupin	1,306	348,702	267	281,220	37%
Mar-Put	917	290,910	317	248,670	66%
Mason	672	305,031	454	268,724	44%
McDonough	1,109	343,322	310	287,506	55%
McHenry	339	72,885	215	63,871	46%
McLean	2,126	745,113	350	701,075	71%
Menard	520	195,294	376	173,752	39%
Montgomery	1,097	300,578	274	266,406	46%
Morgan	1,074	339,977	317	281,595	48%
North Cook	28	6,500	232	6,000	22%
Peoria	1,161	281,122	242	231,630	27%

<u>SWCD</u>	<u>No. Farms in Basin</u>	<u>Farm Basin Acreage</u>	<u>County Avg. Farm Size</u>	<u>Basin Cropland</u>	<u>* % of Total Cropland in Cons. Tillage</u>
Piatt	233	100,889	433	96,135	52%
Pike	475	170,050	358	125,513	58%
Sangamon	1,372	474,352	346	430,446	27%
Schuyler	657	230,699	351	153,151	46%
Scott	454	141,922	313	109,944	64%
Shelby	215	56,545	263	49,171	24%
Stark	474	179,044	378	164,951	43%
Tazewell	1,251	346,950	277	311,348	41%
Vermilion	94	33,840	360	31,237	40%
Warren	470	152,750	325	131,472	51%
Will-So Cook	1,781	396,282	222	360,736	26%
Woodford	<u>1,169</u>	<u>299,557</u>	<u>256</u>	<u>270,687</u>	<u>43%</u>
TOTAL	41,684	13,084,396	314	11,441,976	40%

* Percentage figures are based on all cropland acres within a county's boundaries and do not necessarily correlate directly with cropland acres contained within the river basin for those counties that are not wholly contained within the river basin.

Conservation tillage figures were obtained from the 1986 report of the Conservation Tillage Information Center and include such cultural practices as No-till, Ridge-till, Strip-till, Mulch-till, and reduced tillage. For a cultural practice to qualify as conservation tillage, 30% or more of the previous crop's residue must be present on the soil surface after planting.

ACTIVITIES, PROGRAMS, AND STUDIES

Historically, informational/educational efforts have been the primary means of motivating farmers to adopt conservation farming methods. However, with the adoption of the State's erosion and sediment control program in 1980, the T by 2000 Plan in 1985, and the passage of the Federal Food Security Act of 1985 (Farm Bill), a major shift in emphasis has been placed on farmers to reduce their costs of production and control cropland erosion through implementing conservation practices.

The Erosion and Sediment Control Program establishes a standardized mechanism through which a complaint for excessive erosion can be filed against agricultural landowners. The program legislation also established a cost-share fund within the Department of Agriculture to provide assistance to persons found to be in violation of the standards.

The State T by 2000 plan is a compilation of the plans developed by the 98 Illinois Soil and Water Conservation Districts and establishes a listing of strategies with recommendations to be pursued by the State in achieving the erosion and sediment control goals.

Illustration 1 lists the goals for the State's Erosion and Sediment Control Program.

ILLUSTRATION 1
SCHEDULE for ILLINOIS
SOIL and WATER CONSERVATION DISTRICT'S
SOIL EROSION and SEDIMENTATION CONTROL
PROGRAM and STANDARDS

- January 1, 1983 - Programs EFFECTIVE (in compliance)
Soil loss at or below 4 "T"* (4-20 tons/ac.)
- January 1, 1988 - Land 5% slope or less - "T" or less (1-5 tons/ac.)
Other land - 2 "T" or less (2-10 tons/ac.)
- January 1, 1994 - 1.5 "T" or less (1½-7½ tons/ac.)
- January 1, 2000 - "T" or less (1-5 tons/ac.)

*"T" means tolerable average annual tons per acre of soil loss.

The 1985 Farm Bill established a set of "conservation compliance provisions" which farmers must meet if they wish to remain eligible for USDA program benefits. These conservation compliance provisions require all farmers farming highly erodible land to have a conservation farm plan for controlling erosion developed for all of the land they own or control by 1990. Each farmer must then have his plan fully implemented by 1995 or the farmer will lose eligibility to participate in any USDA programs providing price support, loans or other agriculture benefits. Since over 80 percent of Illinois' farmers participate in one or more USDA programs, it is anticipated that the Conservation Compliance provisions will have a profound and lasting effect on the cropping practices used by farmers.

Conservation tillage practices are the easiest and most economical soil erosion control practices for farmers to implement and these practices will control erosion on gently sloping soils. The fact that farmers are adopting conservation tillage as part of their cropping practices is evidenced by the "% of total cropland in conservation

tillage" column in Figure 1. Conservation tillage alone however, will not control erosion on all lands. The Soil Conservation Service calculates that there are 1,188,700 acres of highly erodible land (HEL) in the Illinois River basin. HEL is land that, because of soil type and/or steepness of slope, is better suited for less intensive agricultural use. The Farm Bill allows for this land to be taken out of production and placed in a permanent cover of grass or trees under the Conservation Reserve Program (CRP).

To date, five different sign-up periods have been held for CRP during which farmers may submit a bid for an annual payment they will accept to take their HEL out of production for a period of ten years. During the first four sign-up periods, 97,681.6 acres were accepted into CRP within the Illinois River Basin counties. River Basin Farmers bid an additional 26,310.1 acres for acceptance during the just completed fifth sign-up. It is expected that approximately 90% of the acres bid will be accepted.

Table 2 provides a list of the counties that are wholly or in part included in the Illinois River Basin, the number of acres that have been bid for acceptance into the program during the five sign-up periods and the percentage of total acres of HEL that have been bid for acceptance into the program.

TABLE 2
HIGHLY ERODIBLE CROPLAND ACRES THAT HAVE BEEN BID FOR
ACCEPTANCE INTO THE CONSERVATION RESERVE PROGRAM BY COUNTY

<u>County</u>	<u>Acres</u>	<u>% of Crop- land Acres of HEL*</u>	<u>County</u>	<u>Acres</u>	<u>% of Crop- land Acres of HEL*</u>
Adams	8,846.6	7.7%	Livingston	2,443.5	16.5%
Brown	1,626.3	6.0%	Logan	497.2	3.1%
Bureau	4,741.0	7.1%	Macon	589.0	5.0%
Calhoun	3,923.6	11.5%	Macoupin	3,570.4	11.1%
Cass	1,268.4	3.7%	Marshall	341.5	.8%
Champaign	458.9	6.9%	Mason	8,133.5	84.7%
Christian	376.8	1.4%	Menard	951.0	4.6%
DeKalb	1,443.7	8.6%	Montgomery	4,532.0	30.4%
DeWitt	199.0	1.9%	Morgan	715.1	1.4%
DuPage	0	0 %	McDonough	1,813.4	6.3%
Ford	1,206.4	6.3%	McHenry	1,932.6	3.8%
Fulton	3,220.4	5.9%	McLean	3,655.4	7.9%
Greene	6,573.1	14.2%	North Cook	0	0 %

<u>County</u>	<u>Acres</u>	<u>% of Crop- land Acres of HEL*</u>	<u>County</u>	<u>Acres</u>	<u>% of Crop- land Acres of HEL*</u>
Grundy	476.1	5.4%	Peoria	460.0	.9%
Hancock	7,353.1	9.1%	Piatt	399.7	10.5%
Henderson	449.0	2.2%	Pike	17,906.7	24.7%
Henry	4,782.1	3.4%	Putnam	231.9	1.5%
Iroquois	1,469.4	19.6%	Sangamon	1,231.4	3.1%
Jersey	2,459.6	4.9%	Schuyler	2,673.2	8.8%
Kane	221.4	.7%	Scott	1,268.5	7.3%
Kankakee	1,107.2	10.6%	Shelby	3,902.2	10.4%
Kendall	159.8	1.7%	Stark	719.3	1.7%
Knox	2,079.1	2.5%	Tazewell	1,105.2	3.4%
Lake	63.4	.5%	Vermilion	2,498.4	10.1%
LaSalle	2,747.9	11.2%	Warren	959.4	2.3%
Lee	1,625.8	6.8%	Will-So. Cook	1,501.2	2.4%
			Woodford	1,081.9	6.6%

*Highly Erodible Land

Total acres bid for acceptance 123,991.7

Total cropland acres of Highly Erodible Land 1,784,900

POSSIBLE COURSE OF ACTION

Though the 1985 Farm Bill is expected to have a significant impact on cropping practices as well as erosion control, it will not in itself correct many of the problems facing agriculture. Many farmers are still unaware of the ramifications of failing to have a farm plan prepared for their farm. Many of these same farmers don't recognize the need to do anything differently than they have in the past even though they may be aware that they are experiencing some soil loss. These farmers continue to apply fertilizers and pesticides at rates and amounts that are unnecessary because they have not been exposed to or taught the use of such management tools as soil testing and crop scouting. These techniques are being used by many farmers to gauge the investment in materials they must make to maximize their returns. In order for these farmers to become more knowledgeable about the alternatives available to them in terms of management practices, alternative land uses, and sources of assistance, it is necessary that a concerted effort be made to provide the appropriate information and training opportunities. It is important that any efforts made be supported by sound research that is relevant to the existing needs and conditions.

- . Soil and Water Conservation Districts need to be funded from dedicated sources of revenue to allow for the continued employment of qualified personnel to assist farmers in developing farm plans and making proper erosion control management decisions. The amount of funds needed is addressed by a recommendation in the Section on Erosion.
- . The University of Illinois Cooperative Extension Service should be provided an additional annual appropriation of \$100,000 to develop training workshops to inform and educate farmers in choosing proper return-maximizing management options.
- . Cooperative State, federal and local efforts to inform farmers of the conservation compliance provisions of the 1985 Food Security Act need to be strengthened.
- . The U of I Agricultural Experiment Station should assume leadership in researching and developing alternative profitable land uses for highly erodible land.
- . Farmers must be informed of the benefits of utilizing soil testing and crop scouting to maximize their profitability by utilizing the minimum effective quantities of fertilizer and pesticides.
- . During the development of conservation farm plans, soil and water conservation districts and the USDA Soil Conservation Service should provide leadership in encouraging riparian landowners to adopt stream corridor protection measures through the use of critical area seeding, vegetative filter strip, and field windbreak practices.

URBAN STORMWATER MANAGEMENT

INTRODUCTION

Illinois has no uniform guidelines for the management of urban stormwater. Many states are legislating broad plans that require county and local officials to submit plans for review by the state to check for compliance with a master plan. Illinois provides assistance to communities in floodplain management and enforces regulations related to the flood insurance program. Other guidelines exist in the recommendations of the state's Water Quality Management Plan (WQMP) and the State Water Plan, neither of which require mandatory compliance.

The WQMP was created to provide a streamlined and consolidated approach to the evaluation of problems in urban stormwater management from the standpoint of receiving stream quality protection and enhancement. The objectives of the plan are consistent with the findings and objectives of the Federal Clean Water Act, Sections 208 and 303 (e), as well as the Governor's directives for a statewide plan for the management of water quality (and water quality related programs).

The State Water Plan was developed to provide guidelines for the management, development, and conservation of the water resources of the State, encompassing surface water resources (rivers and lakes), groundwater resources (public water supply), and atmospheric water (rainfall augmentation, evaporation). In the area of urban stormwater management, the plan is geared towards proper management of storm runoff primarily with respect to alleviating local and downstream flooding in urban areas. Most of the site specific recommendations pertain to the problems of the heavily urbanized northeast corner of the State.

Both of these plans are the results of cooperative efforts of state and local planning organizations.

BACKGROUND

Water Quality Considerations

One of the major activities impacting the Illinois River especially from the Chicago Metropolitan area, is the control/management of urban stormwater. Since in most cases these waters are managed as flood waters, the efforts to "move" water away from developed areas has contributed to increased velocity and transport, causing water quality impacts from pollutants and erosion of waterways.

The WQMP identifies goals and objectives based on the findings of the States 208 Urban Runoff Assessments and National Urban Runoff

Program (NURP). The NURP program was initiated to identify problems related to urban non-point source pollution, to identify the sources of the non-point problem constituents, and to investigate the effectiveness and feasibility of various "best management plans" in controlling the removal of these pollutants before reaching the receiving streams. The program was needed to fill informational research gaps in the Areawide Cleanwater Plans developed under Section 208. The study evaluated the contributions from urban runoff in a 5-year program. The general findings for Illinois communities, and Statewide recommendations are as follows:

WOM Plan Findings

Urban stormwater studies were conducted in the eight Standard Metropolitan Statistical Area (SMSA) urban centers of the State. Bloomington-Normal, Champaign-Urbana, Decatur, Kankakee, Peoria, Quad Cities (Illinois portion), Rockford, and Springfield. These studies were guided in part by local steering committees (LSC) formed to represent each of the eight SMSA's.

Several conclusions were drawn from the SMSA studies in relation to the nature of urban runoff impact on water quality. Lead, copper, and iron exceed the existing general use water quality standards 25 to 30 times per year as a result of urban runoff at various points within each study area, and the once a year maximum may be 15 to 20 times the standard. Biochemical oxygen demand and suspended solids levels in urban runoff are frequently greater than allowable effluent limits for point sources. Limited data suggest that violations of the general use water quality standards for chlorides may occur as a result of urban runoff from snowmelt. Only occasional violations of the ammonia, zinc, and dissolved oxygen general use water quality standards were noted.

These results indicated that current general use water quality standards may not be the appropriate yardstick for problem definition when evaluating the impacts of urban runoff. The LSC's also concluded that the cost of 100 percent compliance could not be justified without a better understanding of the increased beneficial uses which would be gained in area streams.

The Northeastern Illinois Planning Commission (NIPC), a designated water quality management planning agency, emphasized urban runoff water quality problems in the northeastern region of the State. Municipal storm drainage systems were inventoried and analyzed, an extensive runoff sampling program was conducted, and simulation modeling was performed to test the effects of various improvement strategies. It was determined that there were three general categories of control measures to reduce urban runoff pollution: 1) by controlling the design, construction, and maintenance of the drainage network; 2) by preventing pollutants from entering the drainage network; and 3) by treating stormwater to remove pollutants before polluted runoff reaches a waterway.

The NIPC Plan concluded that a comprehensive program was necessary to reduce pollution from urban runoff. There were two phases to the recommended program. The first emphasized voluntary actions by local governments within the areawide framework provided by the Plan. The second phase would involve the issuance of general area or specific permits for individual discharges.

A target reduction of 25 percent in the amount of biochemical oxygen demanding materials (BOD) carried into waterways by urban stormwater runoff was recommended for areas already urbanized. The program also recommended that BOD loadings from areas which will undergo urbanization by the year 2000 be 50 percent lower than the BOD loadings from areas that were already urbanized. An exception to this policy concerned areas draining directly into Lake Michigan. Here, a 50 percent reduction in BOD was recommended for both present and future urban areas.

The NURP study was a national program that funded 28 individual demonstration/research projects throughout the country. Two of those projects were in Illinois; one conducted by NIPC and the other a cooperative effort of IEPA and ISWS. The study identified the nature, cause, severity and possible management methods, related to urban runoff. The conclusions of the study were presented in such a manner as to encourage the recommended preventive measures which could be implemented at the local level.

As participants in the ongoing NURP Study, NIPC soon realized the significance of urban runoff in this area. In 1981 they initiated a survey of communities to establish how many flood detention ordinances and erosion control ordinances were in place. The results were as follows:

<u>County</u>	<u>No. of communities surveyed</u>	<u>% with Flood detention ordinances</u>	<u>% with erosion control ordinances</u>
Cook	115	98.3	29.6
Dupage	30	97.6	53.3
Kane	19	42.1	31.6
Lake	47	66.0	38.3
McHenry	25	48.0	16.0
Will	24	45.8	33.3

The purpose of the survey was to obtain a general picture of the programs in the area, and act as a focal point to introduce the "management through enforced ordinance" concept to those communities surveyed.

ACTIVITIES, PROGRAMS, AND STUDIES

As a continuance of or result of these studies, many organizations have developed model ordinances and management guidances on urban runoff control. As part of their contract efforts with IEPA, the Planning Commissions have continued to focus attention of such

items as detention basin design, stream protection, and the concept of urban runoff control measures within designs of new development.

At the Federal level, interest in urban stormwater management has increased. The National Environmental Policy Act (NEPA) has always required an assessment of primary and secondary impacts from activities sponsored with Federal funds. With the enactment of the 1987 FWPCA amendments (Water Quality Act) renewed and expanded focus on urban stormwater management can be found in Section 319 and 405.

Section 319 (Nonpoint Source Management Programs) requires, among other things, the identification of streams and lakes impacted by urban nonpoint pollution, and the identification of management practices to minimize adverse impacts. Much of this will be derived from the earlier 208 and NURP studies along with any recent information available from the planning commissions and Illinois State Water Survey.

Section 405 (Municipal and Industrial Stormwater discharges) establishes specific dates and criteria for the implementation of a federal/state permit program to regulate discharge from significant storm sewer systems.

Water Quantity Considerations

Whether it is right or wrong, urban stormwater management at the practitioner's level is primarily guided by economic issues. For as long as urban areas have been flooded by both local and upstream storms, the primary emphasis has been put on the topic of how to effectively route these flows to minimize the economic hardships of real property damage and interruption of services (such as transportation and utilities). Water quality issues, although recognized as being important, usually received a lower priority when management decisions are made. The Metropolitan Sanitary District of Greater Chicago (MSDGC) is attempting to satisfy both of these priorities with the Tunnel and Reservoir Plan (TARP) but this plan is the exception, not the rule.

Historically, there have been three major components to an urban stormwater management plan: a conveyance system (storm sewers and ditches), storage facilities (detention basins), and floodplain zoning (flood insurance programs). The efficient merging of these components into a comprehensive plan in developing areas can provide an acceptable solution to the economic issues related to urban stormwater management and also may meet, at least partially, the objectives of the WQMP. The NURP program described previously found that detention and retention facilities in urban stormwater systems can be quite effective, if properly designed, in removal of several constituents commonly found in urban non-point source pollution.

Implementation of stormwater management plans in newly developed areas is not nearly as difficult as instituting a comprehensive plan in existing urban areas. In northeastern Illinois, Chicago and the communities in close proximity are so densely developed that open

space for detention storage is simply not available or is too expensive to obtain. Compounding the problem in Chicago is the existence of combined sewers, which carry both storm and sanitary sewage. The TARP which is currently being implemented by MSDGC is an expensive plan which has been widely and openly criticized. However, taking a look at the storm events of October 1986 and August 1987, the benefits of the project are obvious. In the case of the 1986 storm, nearly 0.5 billion gallons of storm and sanitary sewage were dumped into Lake Michigan. Without TARP, this figure could have been 1.25 billion gallons.

The storm of August 1987 set both rainfall records and receiving water stage records at many locations in the Chicago area. Damages due to the flooding are expected to exceed \$100,000,000. The first phase of TARP is only 50% complete but managed to contain one billion gallons of stormwater. Nearly 1.5 billion gallons were released to Lake Michigan.

CONCLUSIONS

Except for Rockford, Champaign-Urbana and the Quad Cities, all the SMSA urban centers are tributary to the Illinois River Basins Watershed. The findings of these studies and NURP are reflective of what can be found throughout the watershed near urban areas. The need for a "quick-fix" to flooding problems in urban areas has led to increased drainage through channelized streams, culverts or pipes, increasing water velocity which transports larger particles and greater quantities of pollutants from urban centers. Urban stormwater has been identified as a significant problem in the upper reaches of the Illinois River Basin primarily associated with intensive urban development and stream modification for flood control.

The IEPA has encouraged the implementation of the WQMP recommendations through technical and public information activities. Through NIPC, SIMAPC, and the Association of Illinois Soil and Water Conservation Districts (AISWCD), several workshops on urban soil erosion and sedimentation control were held throughout the basin area. Discussions focused not only on technology, but upon effective local management initiatives through ordinances and other control measures. Technical documents on stormwater management continue to be developed and published through these organizations.

The State has continued to research the effects of urban stormwater runoff through studies of the State Water Survey, the regulation of stormwater outfalls causing known water quality violations (NPDES permit), and the development of the IEPA's soil erosion and sedimentation control requirements.

The enactment of the Water Quality Act of 1987 included section 405 "Municipal and Industrial Stormwater Discharge", the Federal response to the conclusions of the 208 SMSA studies, NURP, and further evaluations. This program will mandate management of stormwater discharges by both municipalities and industry where water quality integrity can be impacted. This response is a result of

municipalities and industries throughout the country failing to take proper measures in a voluntary and conscientious manner to control potential water quality violations.

The IEPA has encouraged the implementation of the WQMP recommendations through technical and public information activities. Through NIPC, SIMAPC, and the Association of Illinois Soil and Water Conservation Districts (AISWCD), several workshops on urban soil erosion and sedimentation control were held throughout the basin area. Discussions focused not only on technology, but upon effective local management initiatives through ordinances and other control measures. Technical documents on stormwater management continue to be developed and published through these organizations.

From a statewide perspective, the control of urban runoff is a necessary component to prevent impairment of water uses in an urban setting. Local units of government have primary responsibility for the management of urban drainage.

POSSIBLE COURSES OF ACTION

- Maximize the education/information transfer functions. A program of education/information transfer would: (1) acquaint developers and local officials with the need for use of proper stormwater management techniques, (2) establish and promote anti-litter activities, and (3) inform homeowners of the proper use and application of fertilizers and pesticides.
- Municipalities and counties should adopt and enforce adequate stormwater detention ordinances, as appropriate. Model ordinances developed by the Northeastern Illinois Planning Commission (Suggested On-Site Stormwater Detention Basin Ordinance, January 1980) and Southwestern Illinois Metropolitan Planning Commission (Model Stormwater Detention Ordinance for Developing Areas, January 1982) are available for reference and consideration by individual communities.
- Since it is the primary responsibility of the local, State or federal agency to control urban runoff contributions arising from their individually directed activities and facilities, the following preferred control practices are recommended: administrative procedures for personnel training, improved equipment utilization and scheduling, and controlled application programs for de-icing or other related right-of-way clearance programs.
- Municipalities, township, county and State highway organizations, the Illinois State Toll Highway Authority, and facility engineering departments at State and federal installations should review the effectiveness of programs for control of the application of de-icing materials, personnel training in proper storage and application methods, equipment usage in order to minimize any negative water quality impacts.

- Although TARP has been an expensive undertaking, the potential benefit of the plan has surfaced during its performance during two major storms in the last year. If phase one of the plan is completed, the storage capacity of the system for water to be treated (water quality phase) would increase from the current 1 billion gallons to approximately 2.2 billion gallons. The stormwater storage phase, phase 2, is just starting at the O'Hare site. If completed, phase 2 would provide an additional 15 billion gallons of storage. This additional storage capacity would have significantly reduced the 100 million dollars in damages incurred during the August 1987 event. It is therefore recommended that funding be sought to complete phase 1 as soon as possible. The cost of this work is easily justifiable in relation to the damages that it would help to circumvent. Additional funding should also be sought for at least 50% completion of phase 2 in a timely manner.

COMMERCIAL FISH AND MUSSEL RESOURCES

BACKGROUND - FISH

During the mid-1800's, commercial fishing was a thriving economically important industry within the Illinois River basin, providing good jobs and incomes to thousands of basin residents. The millions of pounds of fish annually harvested from its waters were extremely vital in the feeding of hundreds of thousands of people during the period when the nation's population was expanding at a rapid rate. Likewise, the commercial harvest of mussels from 1890 to 1940, and again since 1963, has also played an integral economic role in the lives of hundreds of other basin residents and their communities.

Although fish and mussels are still being harvested commercially from portions of the Illinois River Basin, the importance of these industries to the basin's economy has declined significantly over the past 70 years due to man's use, abuse or total disregard of its valuable natural resources. The waters of the Illinois River Basin have the potential of producing and yielding greater economic and recreational benefits for its citizens, but such is not likely to occur until the many problems and issues regulating these valuable resources are dealt with in a bold, forthright and constructive manner.

Before the 20th century most native American fishes were viewed solely as an important and valuable food resource -- vital to the welfare of its citizens and growth of the nation. Little attention was given to or value placed on recreation qualities of the species we consider as "game or sport" species today. Walleye, sauger, pike, crappie, sunfish and the various basses, along with the buffalo fishes, catfishes, bullheads, carpsuckers, freshwater drum, sturgeon and paddlefish, were all taken commercially in Illinois prior to 1905.

From 1850 to 1880, before any significant changes occurred within the Illinois River basin and carp were not present, 5 to 10 million pounds of fish were annually harvested from the Illinois River Basin and its tributary streams. As the basin's population grew larger, concern was voiced about whether the river could continue to provide the quantities of fish needed, because for many of its residents, the principal meat available and consumed was fish. Similar concerns expressed in other parts of the country prompted the U.S. Fish Commissioner to authorize the importation of carp in 1879 to bolster the nation's supply of food fish, for such was deemed essential to the nation's growth and welfare. The first distribution of fingerling carp was made in 1881 and what occurred thereafter was to have a significant impact on the commercial fisheries of the Illinois River basin.

Although it was intended that carp be cultured as food fish in farm ponds, many of them quickly became established in the country's lakes and

rivers following the overtopping of or erosion of pond dams. Within nine years following the first stocking of carp in Illinois, the 1891 Report of the Illinois Fish Commissioners stated that carp were becoming abundant in the Illinois River, resulting in some large catches being made. In 1897, Illinois River commercial fishermen harvested an estimated 3,678,000 pounds of carp. Two years later, the Illinois River Basin produced 6,332,990 pounds of carp valued at \$189,981. In 1908, Illinois River commercial fishermen caught a record 24,763,000 pounds of fish valued at \$1,135,000, of which approximately 17 million pounds were carp.

During the 1890-1915 period, except for the Columbia River Basin, the State of Illinois was the nation's leading producer of freshwater fish, the majority of them being harvested from the Illinois River Basin. They were frequently shipped live by the railway carload from such ports as Havana to Chicago, St. Louis, New York, Boston, and Philadelphia. Several thousand Illinois River Basin residents were actively engaged in the harvesting, processing, shipping and marketing of its fish. Chicago soon became the freshwater marketing center of the United States and every Illinois River port could boast two or more thriving fish markets. Because of their great supply and cheap cost, Illinois River fish were the principal meat eaten by hundreds of thousands of immigrants and the poorer classes of people throughout the country during the late 1800's and early 1900's. Illinois River fish were often featured menu items in the finer dining establishments of larger cities.

Man-induced changes in aquatic habitat have been impacting fish and wildlife resources of the Illinois River basin since the early 1900's. The diversion of water from Lake Michigan starting in 1900, while greatly increasing surface water area to the benefit of fisheries, was tempered by aquatic habitat losses through destruction of then existing "inshore and alongshore vegetation" and the flushing of Chicago's sewage and industrial wastes into the Illinois, degrading water quality. As increased quantities of sewage entered the Illinois River, the effect was devastating to its many fishes. Upper stretches of the river became void of oxygen and toxic. Kills of fish and their food organisms became common occurrences. By 1913, the commercial catch of fish plummeted to 10 million pounds, which was approximately the same harvest as that taken from the river in 1897, prior to the diversion. The main reasons appear to be direct effects of toxic sediments on bottom-dwelling fish and loss of a food supply for bottom-feeding fish.

By 1921, the commercial fish harvest had fallen further to 4 million pounds. Unexplainably the harvest rebounded to roughly 10 million pounds the following year. In the summer of 1923, the river was practically anaerobic as far downstream on Chillicothe, with conditions virtually impossible for the existence of fish. In 1928, Thompson found that most carp in the more polluted upper stretches of the river exhibited a rachitic bone malformation of the head and gill covers known as a "knothead" condition. The last year that in excess of 5 million pounds of commercial fish were harvested was 1950. Thereafter, the annual commercial catch continued to decline further as the cumulative loads of toxic materials and sewage from Chicago and other cities bordering the river continued to take a vicious toll on water quality and the production of vital aquatic fish food organisms. Mayflies, which are indicators of clean water and

an important food of many species of fish, were no longer present in the upper two-thirds of the river after 1950. Fingernail clams, preferred by carp, channel catfish, and freshwater drum, virtually disappeared from the river above Beardstown after 1950. The loss of the rivers important fish food organisms was undoubtedly one of the major factors contributing to the ever-declining poor commercial catches from 1950 to the early 1980's.

In 1970, the commercial catch fell below the one million pound mark and continued to decline further until 1978, when a meager 306,016 pounds were harvested from the entire river basin. Since 1982, the annual commercial fish harvest has remained relatively constant at slightly more than one million pounds. This slight increase in the commercial catch can be attributed largely to the passing of more stringent water pollution laws and their enforcement, resulting in some improvement in water quality in that portion of the river upstream of Pekin. Positive changes in the river's sport fish population have also been quite evident. Good walleye, sauger and white bass fishing is now present in the Starved Rock and Marseilles pools of the upper river, where 15 years ago only sickly, scrawny bullheads, goldfish and knothed carp with eroded fins and open sores on their bodies could be found.

The practices of the agricultural community over the past 50 years have resulted in many deleterious impacts to the river and its numerous life forms. The clear cutting of timberlands, the cropping of steep sloped lands, and the intensified production of row crops have resulted in an alarming increase in the rate of soil erosion. The deposition of sediments in the river has resulted in its loss of flow capacity, the filling of adjacent bottomland lakes which are essential fish production areas; and caused the smothering of valuable bottom-dwelling organisms, fish nests and eggs, and the degradation of quality fish habitat, thus affecting the production of both sport and commercial species. The increased production of row crops and practice of monoculture have resulted in greater use of herbicides, insecticides and fertilizers. Many of the agricultural chemicals used are persistent in nature and extremely toxic to fish and their food organisms. When these chemicals are transported to aquatic environments, they are bio-accumulated by some fish, causing their flesh to be unsuitable for consumption.

Another event that has altered the aquatic habitat and water quality of the Illinois River, influencing its production of fish, has been the development of navigation. The ever-increasing barge traffic has resulted in wave turbulences that have increased the turbidity of its waters and caused erosive scouring of river bottom and shoreline directly affecting the ability of some river commercial fishes to feed and reproduce.

In summary, the commercial harvest of fish from the Illinois River Basin has been an important economic activity over the past 125 years, providing jobs and income to thousands of basin residents and contributing to the growth and welfare of the state and nation. The quantities of fish produced within the basin have been determined to a large degree by the cumulative impacts of human activities: the polluting of basin waters by human wastes, industrial and agricultural chemicals; the modification of the river to accommodate navigation, altering its flow, and physical and biological characteristics; and the changes in agricultural practices which

have accelerated the rate of sedimentation and destroyed many of its highly productive bottomland waters and associated overflow lands. The total sum of the many physical, chemical and biological modifications of the basin waters and land has resulted in the virtual ruination of once valuable and vital commercial fishery and other valued natural resources.

BACKGROUND - MUSSELS

Prior to 1900, at least 38 species of mussels were found within the basin of the Illinois River, in varying degrees of abundance. Following the discovery of pearls in the mussels of the Pecatonic River in Wisconsin in 1889, "pearl fever" quickly spread to virtually every midwestern river containing mussels, including the Illinois River and its tributary. Until 1905, the only harvesting of mussel was for the pearls they might contain.

The perfecting of the technique for making buttons from freshwater mussel shells in 1891 developed the Illinois commercial mussel harvesting industry. Initially the mussel shells needed by the button making industry were harvested from the reach of the Mississippi River above St. Louis; however, as the mussel beds were subject to depletion after several years of exploitation, the commercial harvest of mussels spread to other rivers within the Mississippi River drainage basin, including the Illinois River.

In the Report of the State Fish Commission of 1906, "the rapid growing industry on the Illinois River in the taking of mussels for the manufacture of pearls" was noted. Also described were the methods of harvest, the prices paid (\$4 - \$14) per ton of shells, and the profitable income (\$2 - \$7) a man could make in a day. One of the first accounts of the vast quantities of shells harvested from the Illinois River indicated that 19,027,370 pounds or 9,514 tons valued at \$86,000 were harvested from the Illinois River between Havana and Meredosia. The Illinois Fish Commission Report of 1910, stated "The great mussel beds along the Illinois River have attracted to them a large number from other states, until now thousands of men with boats are engaged in digging for them from LaSalle to Grafton along this river". In the Report "Fisheries of the United States, 1908", the value of the Illinois River mussel products (shells and pearls) was documented to be worth \$139,000. This same report stated "The pearl-button industry has a \$2,000,000 capital investment and production of \$6,000,000 of products". The U.S. Fish Commissioners Report of 1913 indicated that 861 basin residents were engaged in mussel harvest, and the value of the shells and pearls taken were worth \$128,892. This report was also the first documented evidence that the commercial mussel fishery of the Illinois River was beginning to decline. Although no poundages or tonnages have been quoted by Starrett, he has stated that the maximum commercial shell harvest occurred in 1909.

Over-exploitation of mussel beds and the rapid progression of pollution on that portion of the river upstream of the Peoria-Pekin metropolitan area were probably the major factors causing the decline in the commercial mussel fishery after 1915. Since 1915, virtually all mussel species upstream of Chillicothe have disappeared because of pollution. Although few specific records are available, it is known that the commercial harvest of Illinois River mussels continued until about 1940 in the river's

reach south of Havana. The manufacture of plastic buttons caused the total collapse of the mussel harvest industry in the early 1940's.

Individuals, who were engaged in mussel harvest on the Illinois River prior to 1940 and are once again active in the same effort, have described that the majority of the river's mussel beds they once harvested upstream of Meredosia are now covered with two to five feet of deposited sediments. This has undoubtedly resulted largely from the increased production of row crop since the early 1940's, resulting in increased soil erosion and rates of sedimentation. Other than the documentation of Paloumpis and Starrett in 1960 of the die-off of fingernail clams, no records exist of mussel mortality.

With the discovery that mussel shells from the Mississippi River drainage basin were the finest material available for the culture of pearls, the mussel harvest industry was revived around 1963. In 1965 and 1966, more than 1,118 tons of mussel shells were harvested from the lower reaches of the Illinois River each year. From 1967 to 1986, the annual harvest of mussel shells from the river has ranged from none to a high of 731 tons in 1985 having value of \$402,452.

ACTIVITIES, PROGRAMS, AND STUDIES

Current programs relating to the commercial fishery have been discussed in detail in the "Aquatic Habitat, Forestry, Wildlife, and Natural Areas" issue paper in this report. These programs all provide necessary research and information relevant to the commercial fishery. These programs are: (1) The monitoring of fish populations at 21 sites on the Illinois River. This program monitors the number and types of fish found by electrofish sampling; (2) the Peoria Lake study being conducted by the State Water Survey, (3) the Natural History Survey study of channel catfish movement during and after a period of navigation shutdown, (4) a similar study being conducted for other fish species by the Department of Conservation, and (5) the team of State agencies and the U.S. Army Corps of Engineers project on safer disposal techniques of dredged material.

Relating to mussel populations, the Illinois Natural History Survey is continuing a study of the impacts of navigation, specifically fleeting of barges, on mussel beds. This study, funded by the Commercial Fisheries Research and Development Act, is being conducted on the Illinois River near Naples to assess mussel stress and mortality from movement and parking of barges in the vicinity of a mussel bed. Initiated in 1983, with an interim report in 1985, the 1987 field work will hopefully complete the study.

CONCLUSION

Because of apparent improvements in the water quality of the Illinois River, especially that portion above the Peoria-Pekin metropolitan area, it is quite likely that populations of the commercial fish species will increase in number, growth and flesh condition. There is current evidence this is occurring. It's highly unlikely that commercial harvest rates of

10 million pounds or more will be realized again, but an annual increase of 2 million pounds or more would certainly result in positive economic benefits within the basin. There is unlikely to be major improvement in the commercial fishery of the Illinois River until the food supply is restored.

The commercial mussels of the Illinois River Basin are undoubtedly facing a tenuous existence. It is unlikely that there will be a significant increase of mussel populations or harvest within the next ten years. The improvement in water quality upstream of the Peoria-Pekin area may result in some areas being repopulated and expansion of the few remaining mussel beds. If efforts are made to identify existing mussel beds in the river, perhaps measures can be taken to prevent their further degradation by industrial, agricultural, and navigational activities.

The commercial fish and mussel resources have both been seriously degraded by increased sedimentation and agricultural, industrial and domestic pollution. Until sedimentation is reduced and water quality is improved, the prospects of these detrimental impacts being diminished are slim.

POSSIBLE COURSES OF ACTION

1. Provide positive and forceful action to resolve the problem of sedimentation on our rivers.
2. Fund research projects designed to alleviate existing problems affecting the aquatic environment and its life forms from such activities as dredging, barge fleetings, shoreline stabilization, and channelization.
3. Encourage the funding of stream habitat creation or improvement projects.
4. Adopt and initiate a statewide greenways concept along major rivers.
5. Encourage the purchasing of floodplain and leveed lands for re-establishment of terrestrial and aquatic habitat.

ARCHAEOLOGICAL, HISTORICAL, AND PALEOBIOLOGICAL RESOURCES

INTRODUCTION

The Illinois River Basin has a long, dynamic, and exciting history. In addition to its geological history, its past is documented by archaeological, historical, and paleobiological sites. These sites record prehistoric and historic cultural development and environmental change for at least the past 12,000 years. Information from these sites is scientifically and educationally significant, and the sites themselves are popular tourist attractions. Important sites are being destroyed at an alarming rate by unregulated landscape modification and shoreline erosion. In most instances, there is no opportunity to adequately protect the most significant sites. Although site inventory and assessment are part of several ongoing federal and state programs, many state actions impact these sites without completing adequate cultural and paleobiological resource assessments. Furthermore, there is no comprehensive cultural and paleobiological resource management plan for the Illinois River Basin. Information from the Illinois River valley is used to illustrate the status of cultural and paleobiological resources and efforts to manage them. The conclusions drawn also characterize the situation in other areas of the Illinois River Basin.

BACKGROUND

The Illinois River Basin includes the Illinois River and its tributaries and their associated interfluvial uplands. Archaeological and historical sites (cultural resources) and fossil localities (paleobiological resources) are found in all of these environmental settings. The following analysis focuses on these resources in the Illinois River valley.

Illinois River Basin habitats have long supported a rich diversity of plant and animal communities attractive to Illinois' residents. The aquatic and terrestrial environs of the valley have provided sustenance and shelter for human groups for at least the past 12,000 years. The river also served as a major transportation and communication link between communities. Prehistoric Native American cultures flourished along the river valley, evolving from nomadic, hunting and gathering families to more sedentary agricultural societies with complex socio-political organization and long distance exchange networks reaching throughout eastern North America.

Euro-American explorers and pioneers were also drawn to the Illinois River valley. French explorers, in particular, documented many Native American villages along the river and established encampments at Starved Rock and Peoria. Pioneers soon discovered that the rich alluvial sediments of the floodplain were well suited to agriculture. The river served as the primary transportation link to the larger markets. Farmsteads, villages, and towns were soon established along the entire length of the river.

The geological character of the Illinois River valley, in particular the aggradation of thick deposits of sediment in the floodplain and along the valley margin, has preserved an extraordinary record of past environments and cultural development. Limited investigations of these deposits have

documented sites along the entire course of the Illinois River. In addition, caves containing fossil-bearing deposits are found along the lower reaches of the Illinois River.

Archaeological sites, localities once occupied by prehistoric or historic peoples, have been documented along the river shoreline, on the floodplain, and in valley margin and upland settings. Camps and villages established near the river by Native Americans are buried in river-deposited sediment. Major villages were often established along the river valley margin. Over the millennia, sediments eroding from nearby bluffs slowly accumulated. Preserved in these deposits, separated by lenses of sediment, are the remains of village sites representing centuries of cultural development. Although the depositional context of upland environments is different, well-preserved archaeological, historical, and fossil sites are found in the uplands as well.

Historic-era sites include both archaeological sites and standing structures. These sites provide a unique perspective of the interaction of Native Americans and Euro-American explorers and pioneers and the commercial, industrial, and agricultural development of Illinois.

Also embedded within deposits of the Illinois River valley and caves within the basin are natural accumulations of plant and animal fossils. These paleobiological sites document the natural history of Illinois and provide a perspective on regional and even global environmental changes. Furthermore, late Quaternary sites provide an independent record of environments and habitats important to human residents.

All these sites are nonrenewable resources. Those sites that remain today represent our only opportunity to learn about the prehistory of the Illinois River valley and although there is an extensive literature on Illinois history, archaeological investigations often provide a perspective of life not systematically recorded in historical accounts. Furthermore, the fossil deposits document environmental history, a record which modern ecologists now recognize as crucial to models of future environmental change.

Archaeological, historical, and paleobiological sites are being destroyed by 1) shoreline erosion and 2) unregulated landscape modification. A recent study of several archaeological sites along the Illinois River shoreline of Pike and Calhoun counties conducted by the State Museum indicates that shoreline erosion is a major factor in the destruction of these sites. Wave action, most of which is attributable to barge traffic, is considered the primary agent of erosion, but water elevation is another significant factor.

The landscape of the Illinois River valley is being modified at a rate unprecedented since large tracts of land were first drained and converted to agricultural production. These modifications facilitate housing and industrial development, transportation, agriculture, and recreation. Most landscape modification is undertaken by private concerns outside the jurisdiction of state and federal government. For example, the Zimmerman site, the Grand Village of the Kaskaskia Indians visited by Marquette and Jolliet in 1673, now listed on the National Register of Historic Places, is currently threatened by a housing development. A substantial amount of land modification is conducted under the aegis of various governmental bodies. The programmatic efforts of the federal and state government to protect

archaeological, historical, and paleobiological sites is discussed in the following section.

ACTIVITIES, PROGRAMS, AND STUDIES

Legislation

All federal undertakings that modify the landscape are subject to a series of historic preservation laws (especially the National Historic Preservation Act, 1966) that mandate archaeological and historical site inventory and site assessment. This federal legislation created the Illinois State Historic Preservation Office (SHPO) (as part of the Illinois Historic Preservation Agency (IHPA)) that is charged with the creation of a state-wide preservation plan for the treatment of archaeological, historical, and architectural resources. Unfortunately, this plan has never been completed due to lack of staff and funding. Illinois' Archaeological and Paleontological Resources Protection Act provides safeguards for cultural and paleobiological sites on public lands, but it does not require that state agencies conduct site inventories and site assessments. Nevertheless, some state agencies, primarily the Illinois Department's of Transportation and Conservation, and all "Build Illinois" projects, are evaluating and protecting cultural and paleobiological resources under agreement with IHPA in the absence of federal involvement. Unfortunately, this policy is not consistently applied throughout all agencies of state government.

Site Inventory and Assessment

The Illinois Archaeological Survey (IAS), a not-for-profit corporation of professional archaeologists, maintains a comprehensive file of archaeological sites in the state. The Illinois State Museum and Historic Preservation Agency have access to a computer-based version of this file.

The most comprehensive archaeological survey of the Illinois River Basin, the Historic Sites Survey, which was conducted during the early 1970's, was funded by the SHPO. Although hundreds of sites were identified in the Illinois River valley and its tributaries, vast expanses of the Basin remain unsurveyed.

The U.S. Army Corps of Engineers is also heavily involved in activities that affect cultural and paleobiological resources along the Illinois River shoreline and floodplain. Although the U.S. Army Corps of Engineers has funded site inventories for extensive sections of the Illinois River valley, most of the valley has not been systematically surveyed. In addition, the Corps does not currently have a comprehensive program to protect significant sites threatened by destruction from cultural or natural factors. In fact, the resource trend analysis program coordinated by the U.S. Fish and Wildlife Service for the Upper Mississippi River System Environmental Management program does not incorporate cultural resources.

The United States Congress has designated a 120 mile long cultural park between Chicago and Peru as the Illinois and Michigan Canal National Heritage Corridor. The National Park Service has initiated an inventory of archaeological resources in the corridor.

The Illinois Department of Conservation is conducting cultural resource

assessments in state parks where facilities are being developed or renovated. This program recognizes State Parks as conservancies of both Illinois' natural and cultural resources.

Segments of the Illinois River Basin have been surveyed under the auspices of the Fish and Wildlife Service and the Illinois Department of Transportation. Results of these projects have not been compiled into a comprehensive statement on cultural resources in the Illinois River Basin.

Through the Office of Surface Mining and Illinois Department of Mines and Minerals sponsored Lands Unsuitable for Mining program, the State Museum has developed a computer-based archaeological site file by transforming the IAS files into a digital format. This file includes archaeological and historic information, maps of site locations, and a bibliography of research reports on Illinois archaeology. Development of a file summarizing other attributes of archaeological sites such as age and physiographic setting is underway. In addition, a paleobiological site file and bibliography are currently being developed. These files provide a solid foundation for managing Illinois' cultural and paleobiological resources, but they are incomplete.

One limitation of the State Museum data file is the lack of information on historical sites and standing structures in the River Basin. The Illinois Historic Preservation Agency manages an extensive index card file on these properties that could be made more accessible by conversion to computer-based files. The addition of these files would complete a comprehensive file of all cultural and paleobiological data. These files would reside in interconnected files to insure that a comprehensive assessment of known cultural and paleobiological resources could be completed for any particular parcel of land.

Public Programming

There are a number of existing facilities that interpret the cultural and natural heritage of the Illinois River valley. These facilities include the Illinois and Michigan Canal National Heritage Corridor and Interpretive Center, Lockport Museum and Pioneer Settlement, Starved Rock State Park, the Chicago Portage National Historic Site, Dickson Mounds Museum, and the Kampsville Archaeological Museum and numerous small historical society museums. Each of these facilities has ongoing and/or planned programs that present information about the cultural heritage and/or environmental history of Illinois. These programs are popular and annually attract tourists from throughout the Midwest.

The aforementioned facilities represent a small fraction of parks and recreation areas along the Illinois River. There are numerous State Parks, Fish and Wildlife Management Areas, and Conservation areas that develop public programs about the modern ecology of an area. These areas also contain records of the past and in fact serve as conservancies for archaeological, historical, and paleobiological sites. They provide ideal locations for the development of public programs and exhibits on cultural and environmental history.

There are plans to develop a National Historic Trail from the Chicago Portage National Historic Site to the Mississippi River at Grafton following

the historic water route of the Illinois River and the Illinois and Michigan Canal. The planning process is taking into account cultural site attractions along the proposed route. These sites are recognized as opportunities for developing recreational and educational facilities.

CONCLUSIONS

Archaeological, historical, and paleobiological sites in the Illinois River valley preserve a unique perspective of Illinois' past. These sites are resources of scientific and educational information, and recreational opportunity. Unregulated landscape modification and shoreline erosion are destroying sites at an alarming rate. Although significant strides have been made in efforts to protect the Illinois' cultural and paleobiological resources, adequate management of Illinois River valley sites is seriously limited by three factors, 1) the absence of a comprehensive inventory of cultural and paleobiological resources, 2) the lack of a program to monitor and protect significant sites in jeopardy of destruction by natural or cultural factors, and 3) the lack of a comprehensive cultural and paleobiological resources management plan.

POSSIBLE COURSES OF ACTION

As outlined in the 1987 Governor's Task Force on Tourism report, it is essential that the state more vigorously protect Illinois' historic resources and cultural heritage, as well as its paleobiological resources. This can best be achieved by initiating a program through which sites will be inventoried and assessed for National Register eligibility and scientific importance, and by developing a management plan to insure that the most significant sites are protected and preserved.

The following courses of action for the management and development of archaeological, historical, and paleobiological sites are recommended.

- 1) Compile, summarize, and evaluate existing records of sites in the Illinois River Basin;
- 2) Integrate existing information about cultural and paleobiological resources in the Illinois River Basin into an overall management plan to protect and develop these resources;
- 3) Inventory archaeological sites, standing structures, and paleobiological sites in areas inadequately surveyed;
- 4) Nominate eligible archaeological and historical sites for inclusion on the National Register of Historic Places
- 5) Collaborate with other management agencies to a) identify factors affecting the preservation of cultural and paleobiological resources and b) participate in studies to measure the impact of factors affecting these resources;
- 6) Implement pilot studies to monitor and protect significant sites.
- 7) Establish state historic preservation laws modelled after existing federal legislation to insure adequate protection of significant cultural and

paleobiological sites.

- 8) Develop some significant sites for tourism and the education of Illinois citizens.

ECONOMIC DEVELOPMENT

INTRODUCTION

The twenty-one counties adjacent to the Illinois River form an important economic and demographic region in the State of Illinois. The region contains more than half the state's population, although several counties in the region have no urban population. Although most of the region's counties are below the state average in per capita personal income, Cook County is above the average, and several of the counties had total personal incomes of more than one billion dollars. The majority of adults in all but one county had 12 or more years of school. The region accounted for 18 percent of the State's livestock receipts, and 17 percent of crop receipts. With Cook County, the region is an important industrial area, with substantial employment in all major industries. The services industry is the largest employer with 679,596, followed by manufacturing with 609,331. The region receives over 60 percent of statewide travel expenditures, with Cook County receiving the largest portion of that percent.

BACKGROUND

The key to the success of the Illinois economy is cooperation among business, government, labor and individual citizens. As the public and private sectors have begun to better understand their importance to each other, they are combining resources to raise economic development efforts to new highs. The Department of Commerce and Community Affairs (DCCA), the state's primary economic development agency, is working to reshape attitudes toward business development that will foster greater cooperation between the private and public sectors. The wide range of services geared to promote economic development and improving the quality of life, through grants to communities, loans to businesses and job training programs to individuals, is helping to create economic activity which puts more Illinoisans to work.

ACTIVITIES, PROGRAMS, AND STUDIES

The Build Illinois Program enables the Department to integrate its programs with other state, local and federal programs to capitalize on economic development opportunities and to prepare the state's economic infrastructure for the future. The Department of Commerce and Community Affairs' Build Illinois programs include: Corridors of Opportunity; Large Business Loan; Infrastructure Development; Small Business Loan; and Incubator Development.

Build Illinois Corridors Of Opportunity And Development Program

The purpose of the Corridors of Opportunity and Development program is to encourage economic development through regional cooperation.

The program strategy embraces the principle that a diversified economy can be established through the specialization of certain regions, defined by transportation routes and the availability of key resources to attract targeted industries. Grants are available to corridor councils to assist in the achievement of their individual marketing plans and development strategies.

The corridor councils, composed of area representatives, will structure and implement a development strategy for a particular corridor of opportunity. These councils also will play a crucial role in the implementation of the program and the access of available matching funds. Individual councils are representative of the entire region, identifying all the various resources of a region for marketing purposes, so companies will know the benefits of expanding or locating there. Each area is encouraged to develop its assets on a multi-county, multi-municipality basis, thereby fostering regional cooperation. The approved corridors within the Illinois River basin are described in the following paragraphs.

Crossroads of Opportunity Corridor -- This includes 37 communities in the southern suburbs of Chicago. The South Suburban Regional Economic Development Coordinating Council, in conjunction with other area organizations, will utilize the \$152,200 grant to implement a marketing and promotion program for the economic development of the region. Activities will include: the identification of targeted industries for attracting business; the development of marketing brochures; direct mail campaigns; marketing follow-up through telephone and direct client contact; advertisements in trade journals; and public relations efforts to promote the results of a regional Fantus business climate study.

Argonne Regional Consortium -- A grant of \$21,000 was awarded for a high Technology Corridor to serve southwest Cook, northeast Will and southeast Kane counties. Funding will support a feasibility study for the development of a technology-oriented small business incubator at Argonne National Laboratory and the development of technical requests-for-proposal for its construction, as well as an assistance program to secure Argonne supply contracts for small to medium-sized businesses within the consortium's region.

Lake County Economic Development Commission -- The Commission received a grant of \$48,910 for a High Technology Corridor of Opportunity in Lake County. This corridor will focus on the attraction of firms specializing in raw materials and peripheral pharmaceutical supplies and recruiting specific high technology industries. The expansion of high technology business will be accomplished through a marketing campaign to identify appropriate sites, provide information on existing business locations and the development of a survey instrument.

Enterprising Zone Corridor Council -- It will serve Fulton, Peoria, Tazewell and Woodford counties. The Economic Development Council for the Peoria Area was granted \$40,000 to commission an independent, professional research firm to do an in-depth, current analysis of the region's labor market. The study

will examine: available skill levels of people in the region; levels of under-employment; wage rates; level of unionization by job category; and absenteeism. The information will be used to develop a marketing campaign for the corridor.

Central Illinois Corridor of Opportunity -- It will serve Bureau, LaSalle, Putnam, Marshall, Peoria, Woodford, Livingston, Iroquois, Fulton, Tazewell, McLean, Ford, Mason, Logan, DeWitt, Sangamon, Macon, Piatt, Champaign, Vermilion and Menard counties. This council will develop and implement a Central Illinois marketing program which consists of three components: research; development of marketing tools; and marketing activities. Under the research component, a consultant will study the cost factors associated with doing business in Central Illinois. The marketing tools component includes the development of a regional promotional publication with community or company-specific inserts. In addition, a multi-media/video marketing production will be prepared. To complete this program, a comprehensive marketing plan will be developed. Implementation of the plan includes space advertising and targeted marketing activities. Grant funding was \$150,000.

Illinois and Michigan Canal National Heritage Corridor -- It received a grant of \$85,770 and serves Cook, Will, Grundy, LaSalle and Bureau counties. It is based upon a system of major transportation links between the Great Lakes and the Mississippi River. The corridor offers programmatic links to integrate recognition and interpretation of the area's natural and historic resources with the development of its recreation, tourism and economic potential. The Illinois and Michigan Canal National Heritage Corridor Commission will conduct a feasibility study to define key themes for the corridor and identify site locations for information centers. Following the initial study, specific program plans and an implementation strategy will be developed for each site location.

Northern Automotive Corridor -- This Corridor serves communities geographically located along Routes 51 and I-74 in Stephenson, Winnebago, Boone, Ogle, LaSalle, DeKalb and Peoria counties. The Council, utilizing its grant of \$90,000, will implement a multi-faceted marketing campaign to include a series of targeted direct mailings to high potential supplier firms in both the U.S. and Japan, a cooperative print media campaign in auto industry trade publications and a program to promote existing Illinois companies as viable local suppliers to the Midwest.

Chicago Economic Development Commission -- It was allocated \$825,000 to develop a five-year economic development plan for the City of Chicago. The Commission will bolster the tourism/convention business, develop a comprehensive strategic plan for the development of Chicago as a financial services center, identify ways to keep and attract Chicago's professional and skilled personnel in the area and develop Chicago's neighborhoods and industrial parks.

I-57 Corridor -- This focuses on high technology and centers along I-57 from Will County to Champaign-Urbana. The Council, which received a grant of \$49,955, will implement a targeted marketing campaign for the region. As part of the campaign, a marketing brochure and slide presentation will be developed, and a media advertising campaign will be conducted. In order to attract target industries to the corridor, participating communities will conduct a direct mail campaign.

Additional corridor projects will be funded as new councils develop. Future funding priorities will be given to support activities identified in currently funded feasibility studies.

The Department of Commerce and Community Affairs reports annually to the Governor and General Assembly on the status of all corridors of opportunity, including a description of each, the funds allocated and their purpose, and any feasibility studies and marketing plans that have developed as a result of the state expenditures.

Build Illinois Large Business Development Program

The Large Business Development Program provides direct financing to large businesses locating in Illinois or for the expansion or retention of existing Illinois firms.

Financing awards are made on a highly selective basis. The program provides long-term, fixed-rate, low-interest loans and is an integral part of the Build Illinois initiative to further economic development and job creation in the State of Illinois.

The program provides loans which will not exceed 25 percent of the total cost of a project up to a maximum of \$2 million. The business must leverage or include additional financial resources for the project. The Department Director may waive the limit and percentage if a larger amount is necessary to accomplish the purposes of the program. The money can be used for land and buildings, machinery and equipment, construction or renovation and infrastructure improvements/site preparation.

For the purposes of this program, a company must be mature and stable, with a well defined market, employ at least 500 employees, have a proven record of earning, sell their products or services to regions beyond Illinois and have multi-state location options.

Build Illinois Large Business Development funds have been awarded to the following businesses located in counties bordering the Illinois River.

Peoria County--The AMKOR Corporation received \$1,500,000, in Fiscal Year 1986, to be applied toward the construction of the 220,000 square foot automotive replacement filter manufacturing facility in the southtown area of Peoria. AMKOR will incorporate "state-of-the-art" equipment and processes into this operation that will allow production to Japanese and American automakers' specifications. Approximately 700 jobs will be created.

The City of Peoria received \$2 million, in Fiscal Year 1986, to assist in the Southtown I AND II blight removal program implemented in 1974. The 300-acre site is adjacent to downtown Peoria.

The City of Peoria received \$900,000, in Fiscal Year 1987, for further land acquisition and clearance in the Southtown Redevelopment area.

Tazewell County--The City of Morton was reimbursed \$37,517, in Fiscal Year 1986, for options to purchase real estate for potential sites for the planned Diamond-Star Motors Corporation project.

The City of Pekin received \$1 million, in Fiscal Year 1987, to construct a 33,000 square foot building between 2nd and 3rd Streets and Sabella and St. Mary Streets. The building will be leased mostly to state agencies.

Cook County--The Melrose Park Development Corporation received \$950,000, in Fiscal Year 1987, to create the Mid-Metro Industrial Park at Lake Street and Carson Drive in Melrose Park. Up to 900 jobs will be created and retained through this project.

OSI Industries received \$675,000, in Fiscal Year 1987, for the purchase, expansion and improvements of their Chicago plant. As a result of the project, 225 jobs will be created and 355 jobs retained within eighteen months of the loan award.

Build Illinois Public Infrastructure Program

A top priority of Illinois communities is the repair and replacement of decaying water and sewer systems, bridges, roads and schools, an expense few local governments can afford to finance entirely with local funds. As resources to fund capital improvements diminish, Illinois communities are blending traditional debt instruments and grants in innovative ways and making use of a wide variety of state and federal funding mechanisms.

During the 1985 Spring legislative session, the Illinois General Assembly established the Build Illinois Public Infrastructure Loan and Grant Program. The program targets Illinois communities (without regard to population) where infrastructure development or improvement is essential to initiate the expansion or retention of an existing firm or to attract a new firm. Funds are awarded on a specific project basis with emphasis placed on significant job creation or retention. Public Infrastructure Funds have been awarded to the following communities in counties bordering the Illinois River.

Tazewell County--The Village of Mackinaw received \$140,000, in Fiscal Year 1986, for the construction of roads and water improvements to Fitzgerald Equipment Company and Meyer Agri-Products. As a result of this project, 32 jobs will be retained.

Will County--The Village of Crest Hill received \$75,000, in Fiscal Year 1987, to extend a 12-inch water main to Canton Farm Road to benefit Hendrickson Stamping Company. Fifteen jobs will be created.

The Village of Mokena received \$1 million, in Fiscal Year 1987, for infrastructure improvements to extend water and sewer lines along 191st Street, from Wolf Road to U.S. 45.

The Village of Beecher received \$305,000, in Fiscal Year 1987, for construction of a well, wellhouse and looping of several dead end water mains to provide a safe and adequate water supply.

Cook County--Calumet City received \$294,200, in Fiscal Year 1987, to induce V-G Supply Company to locate a warehouse distribution facility. The company proposes to purchase a vacant 60,000 square foot warehouse and renovate the facility to enable the location of the distribution warehouse. Grant funds will be used for extension of water line, sewer line, paving and lighting. As a result of this project, seven jobs will be created and 37 jobs will be retained.

The Village of Crestwood received \$1 million, in Fiscal Year 1987, to pay for improvements in the village's water system which will allow it to join the Mid-Mark Water Commission. Mid-Mark presently supplies a reliable source of Lake Michigan water to the Village of Midlothian and the City of Markham. By joining Mid-Market and completing improvements, the Village of Crestwood will solve supply and pressure problems created by recent growth and increased consumption. Furthermore, the changes will meet future growth and increase in consumption. The project will create 200 jobs.

The Village of Park Forest received \$750,000, in Fiscal Year 1986, to complete the necessary infrastructure serving the village's industrial park. The improvements will consist of earthwork, pavement construction, storm and sanitary sewer construction and street-lighting installation. The project will create 75 jobs and retain 34 jobs.

Northwestern University Research Park received \$500,000, in Fiscal Year 1987, to upgrade the Center for Multiphase Flow and Transport. The Center, affiliated with the Basic Industry Research Institute, consists of faculty from five engineering departments of the Technological Institute--the Departments of Mechanical and Nuclear Engineering, Biomedical Engineering, Civil Engineering, Engineering Sciences and Applied Mathematics, and Chemical Engineering--all have common research interests in momentum, energy, and mass transport in multiphase flow. The net result will be the modernization of four general laboratories plus an hydraulic laboratory. In addition, Build Illinois Program funds will be used to purchase movable and scientific equipment for the Center.

Chicago Industrial Areas received \$3 million, in Fiscal Year 1987, for comprehensive improvements to streets in the City of Chicago serving industrial areas. The improvements will include street resurfacing and reconstruction, installation of traffic signals, railroad crossing construction repair, landscaping, hydrant and light pole relocation, sewer and railroad line improvements and utility relocation and removal, and repairs to the Ogden Avenue viaduct, curb, gutter and sidewalk repairs as necessary.

The Illinois Export Development Authority received \$1 million, in Fiscal Year 1986, to establish a reserve fund. The reserve fund is necessary for the Authority to receive an "AA" rating on its bonds. The Authority can then issue \$15 million in bonds and use the proceeds to assist international trade transactions. The Authority will deposit the funds in a lump sum in an account to be overseen by a trustee. The funds will be "rolled over" to support additional bond sales after the initial \$15 million issue matures.

The Village of Brookfield received \$1 million, in Fiscal Year 1986, for improvements on Maple Avenue. The improvements consisted of the construction of new pavement, rehabilitation of sanitary sewers, water main valves, curbs, gutters, sidewalks, storm sewers, drainage gutters and associated work.

The Village of Lansing received \$1 million, in Fiscal Year 1987, to improve the Ridge Road and Wentworth Avenue intersection. The project will provide a five-lane cross section with an expanded lighting system.

Lynwood received \$500,000, in Fiscal Year 1987, to construct a 500,000 gallon, elevated water storage reservoir including foundation, asphalt surface access driveway, landscaping, on-site water supply piping, pumping system, automatic control modifications and the required engineering services for the project.

The Village of Berkeley received \$800,000, in Fiscal Year 1987, to correct deficiencies in their water distribution system. They will construct a 250,000 gallon elevated tank, install water mains and a loop for the distribution system, and replace all defective water distribution valves.

Sauk Village received \$250,000, in Fiscal Year 1987, for the improvement of the Lincoln-Lansing drainage ditch. The improvement will extend along the ditch from the vicinity of Jeffrey and Yates Avenue through the corporate limits of Sauk Village of the Linwood Reservoir. The improvement consists of the regrading of the ditch bottom and side slopes to improve flow characteristics. Erosion control measures will be employed to prevent further deterioration of the ditch which provides storm water drainage for the predominantly residential area of the Village.

The Village of Melrose Park received \$25,000, in Fiscal Year 1987, to complete improvements to streets and alleyways in the central business district. As a result of these improvements, traffic flow in the business district will be greatly improved.

The City of Blue Island received \$150,000, in Fiscal Year 1987, for a water and sewer line extension.

The Village of Franklin Park received \$25,000, in Fiscal Year 1987, to assist in facade rehabilitation. The rehabilitation of commercial structures in the central business district will assist in the revitalization of the village.

The City of Chicago received \$50,000, in Fiscal Year 1987, for initial costs associated with the expansion of DuSable Museum of African American History.

Build Illinois Small Business Development Program

The Small Business Development Program provides direct financing to small businesses (less than 500 employees) for expansion and subsequent job creation or retention along with a participating financial institution. The program provides favorable financing through long-term, fixed-rate, low-interest loans. The program is an integral part of the Build Illinois initiative to further economic development and job creation in the State of Illinois.

The program provides loans which will not exceed 25 percent of the total cost of a project up to a maximum of \$750,000. The business must leverage or include additional financial resources for the project. The money can be used for land and buildings, machinery and equipment, working capital and construction, renovation or leasehold improvements.

Build Illinois Small Business Micro Loan Program

The Small Business Micro Loan Program provides participating direct financing to small businesses at a below-market interest rate in cooperation with private sector lenders. The purpose of the program is to help small businesses create or retain jobs and assist in providing businesses with the opportunity to expand. Funds may be used for acquisition of land or buildings; construction, renovation or leasehold improvements; purchase of machinery or equipment; or, inventory and working capital.

In Fiscal Year 1987, Small Business Micro Loans assisted the following businesses located in counties bordering the Illinois River: Dave Lewis Photography, Canton; Daniels Auto Supply, Braceville; Just Ears & Yesterday's Child, Inc., Peoria; Helen Gallagher's Enterprises, Inc., Peoria; Performance Pattern & Mold, Inc., Peoria; J.A. Hauter, Inc., Elmwood; Aggregate Equipment & Supply, East Peoria; Tompco, Inc., North Pekin; Advance Thermal Products, Schiller Park; Donut, Inc., Homewood; and in Chicago ETY Engineering; Instant Identification Images, Inc.; Lloyd M. Hughes Enterprises, Inc.; A-1 Box & Paper Company, Inc.; Aldridge Metals.

Build Illinois Small Business Incubator Program

During the 1985 Spring legislative session, the Illinois General Assembly established the Illinois Small Business Incubator Program. The program encourages business start-ups and job creation by offering funding support for

the development of small business incubators. Local government units, not-for-profit economic development organizations, educational agencies or any combination thereof may apply to the Department of Commerce and Community Affairs for financial assistance up to 50 percent of the cost of a local incubator project.

The business incubator is an innovative technique used by private developers and units of government to nurture fledgling businesses. Small business incubators can keep potentially large overhead costs manageable by paying for services on a shared basis or on a fee-for-service basis. The cash flow benefits, access to business assistance sources and the interaction with other entrepreneurs in an incubator facility can greatly improve the chances of success for start-up companies. As a support system, the incubator helps entrepreneurs become more experienced managers capable of dealing with daily operations.

Incubator facilities are generally targeted towards small firms that may require support in the areas of management technical or financial operations. Incubators are typically large commercial or industrial facilities subdivided to meet tenant needs for access to shared, centralized services such as receptionists, clerical and administrative help, shipping and receiving facilities and building security.

Many incubators provide direct management assistance counseling as well. Professional consulting services often include information on small business regulations; access to training in basic management and organizational skills; advertising, promotion, marketing and sales information; purchasing, control and distribution of inventories; recruitment of employees and labor relations, and financial counseling in areas like risk management, taxes, insurance and sources of capital.

Small business incubators are funded at major Illinois public and private universities with well established technology transfer programs and a demonstrated capacity to work with emerging business. In Fiscal Year 1986, over \$1 million in Build Illinois program funds were awarded to incubator facilities -- two in Chicago, and one each in Decatur and Springfield. Financial assistance has been provided to incubators in Rock Island, Moline, Galesburg and Manteno. University-based incubators in Chicago, Evanston, Peoria and Champaign have been financed with Build Illinois and Technology Commercialization Center funds. In addition to these facilities, the state assisted with the development and funding of other incubators in Chicago, Bradley, Decatur, Galesburg, Macomb, Monmouth, Quincy, Rockdale and Rockford. These incubators have attracted over 56 firms and have created more than 460 firms. A Total of eight incubators have been funded by the State of Illinois at a cost of \$2,540,725. Additional technical assistance is available through the Department of Commerce and Community Affairs' publication "Small Business Incubators: Handbook for Sponsors and Developers," "Guidelines for Determining the Feasibility of a Small Business Incubator" and "Managing a Small Business Incubator."

Build Illinois Equity Investment Fund

The Build Illinois Equity Investment Fund, a revolving loan fund administered by the Department of Commerce and Community Affairs' Small Business Bureau, was established in 1985 to provide capital for technology-based companies to undertake substantial job growth and expansion projects. The Equity Investment Fund can provide up to one-third of anticipated project costs, which may be used for the purchase of real estate, machinery and equipment, working capital, research and development costs or organizational fees. Any new or existing small business located or to be located in Illinois may apply for program funds. Investments will be recouped through royalties on product sales, participation certificates or repurchase of company stock. During Fiscal Year 1986, \$933,000 was invested and 300 jobs were created. In Fiscal Year 1986, Cell Analysis in Lombard received \$250,000 to create 33 jobs.

Tourism Programs

The Department's Office of Tourism has embarked on an extensive advertising campaign aimed at creating an inviting image for Illinois. Through its programs and advertising campaign, the Office of Tourism seeks to make Illinois one of the top tourist attraction states. The competition among surrounding states is very keen. The Department's goal is to portray Illinois as the Gateway to the Midwest in the international market and to make it the leader in the tourism industry.

The travel industry is a major factor in the Illinois economy. More than 30 million persons traveled in the state in 1986 and spent \$9.4 billion. Illinois has consistently ranked among the top ten states in recent years in travel expenditures. The federal, state and local taxes that resulted from the 1986 travel in Illinois amounted to \$1.3 billion. The travel industry is also a major employer. In 1986, 157,019 Illinoisans were employed in the travel industry with a payroll of \$2.2 billion.

Travel Expenditures

Although all the counties in the Illinois River region garner travel expenditures, the spending is most significant in Tazewell, Peoria, LaSalle, and Will counties, and especially Cook County. Several counties receive relatively low, but not inconsiderable, expenditures, including Scott, Brown, and Putnam counties.

In 1985, the state received \$8.3 billion in travel expenditures. The Illinois River region received nearly 66 percent of the statewide total, with Cook County receiving nearly 60 percent of that total. Will County, however, ranked second in income from travel, followed by Peoria County. Tazewell and LaSalle counties also received significant travel expenditures.

The Department of Commerce and Community Affairs administers numerous other programs assisting communities to improve their opportunities for economic development. Additional information is available by contacting the Department.

